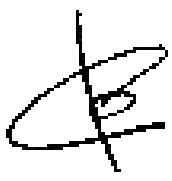
All.4.2.3 SISTEMA RILEVAZIONE PERDITE GASOLIO



IMPIANTI ENERGIA SRL

Eneria CAT

Reparto gruppi di continuità lotto DC-L07

Impianto di monitoraggio perdite gasolio

DATA 4 Group

RELAZIONE TECNICA

PRADA *tec* S.r.l.
Cesare ing. Prada

1- PREMESSA

La presente relazione tecnica intende fornire la descrizione sulla consistenza e tipologia degli impianti previsti per la rivelazione di perdite e sversamenti di gasolio relativi all'impianto di alimentazione di n°8 gruppi elettrogeni del lotto DC L07, installati all'interno del complesso sito in via Reiss Romoli nel comune di Settimo Milanese (MI), di proprietà della società DATA 4 Group.

I sensori di rilevazione perdite all'interno dei pozzetti dei serbatoi, dei pozzetti di raccordo e dei contenimenti cordolati nelle sale GE, sono funzionali alla segnalazione delle perdite delle flange di accoppiamento delle tubazioni di alimentazione gasolio nel reparto gruppi elettrogeni e dei gruppi elettrogeni stessi.

Tutte le alimentazioni dei sensori e i relativi segnali di allarme presenza perdite fanno capo al relativo quadro di alimentazione, da cui, a carico del cliente, devono essere a sua volta raccolti e cablati i segnali sul sistema di allarme perdite del cliente.

Costituiscono parte integrante della relazione i seguenti documenti:

NOME DOCUMENTO	CODICE
Relazione tecnica	**609-IREL-004**
Elenco cavi elettrici	**609-IICL-004**
Schema elettrico quadri alimentazione livellostati	
Manuali livellostati	**KA143F**
Technical Information Liquiphant M FLT51	**T1328F**
Schema funzionale	**609-ISCH-004**
Certificati quadri, installazione e collaudo	
Data sheet cavi	**FG16OR16 0,6/1 KV**

A cui dovrà essere fatto riferimento per la descrizione gli impianti.

2 –DESCRIZIONE GENERALE

I gruppi elettrogeni di soccorso al fabbricato unità DC-L07 sono 8 in totale e sono suddivisi in due aree distinte speculari (tranne i serbatoi dell'area SUD, disposti nel lato Ovest): una a NORD (Gruppi elettrogeni A-B-E-F e i rispettivi serbatoi di alimentazione esterni S1, S2, S5 e S6) e una a SUD (Gruppi elettrogeni C-D-G-H e i rispettivi serbatoi di alimentazione esterni S3, S4, S7 e S8).

Complessivamente, l'impianto di rilevazione perdite asservito al reparto gruppi elettrogeni del lotto DC L07, è costituito da n°24 sensori di livello (Livellostati a forchette vibranti) di cui n°4+4 posizionati all'interno del reparto nelle canalette contenenti le tubazioni di trasferimento del combustibile dai serbatoi interrati esterni ai gruppi elettrogeni, con funzione anche di raccolta degli eventuali sversamenti dei gruppi elettrogeni dal contenimento cordolato, e n°8+8 installati esternamente: n°4+4 nei pozzetti di ispezione tubazioni esterni ingresso reparti e n°4+4 nei pozzetti di servizio di ciascuno dei 8 serbatoi interrati da 40mc di stoccaggio del gasolio.

L'esatta ubicazione dei sensori e dei quadri elettrici di alimentazione e morsettiere segnali è evidenziata nella relativa planimetria allegata 609-IILD-001.

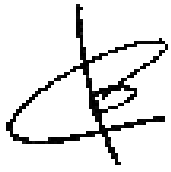
L'alimentazione elettrica, in bassa tensione 24V CC con sistema FELV, è fornita da un alimentatore stabilizzato posto nel relativo quadro di alimentazione realizzato in esecuzione stagna e ubicato esternamente in adiacenza ai box scarico autobotti.

Sono previsti due quadri separati: uno per i sensori relativi ai gruppi elettrogeni A-B-E-F (lato NORD) e uno per i sensori relativi ai gruppi elettrogeni C-D-G-H (lato SUD).

I segnali di allarme generati dalla presenza di sversamenti e perdite, sono cablati nelle apposite morsettiere presenti nel quadro di alimentazione che a sua volta devono essere cablati dal cliente sul proprio sistema di controllo e allarme perdite.

L'alimentazione dei quadri locali è a 230V 50Hz monofase, consumo massimo 100W cadauno.

I limiti di batteria dell'impianti sono i seguenti:



- A monte: Ai morsetti di uscita dei quadri locali QE, sia per le alimentazioni a 230V, sia per i segnali di allarme.

La tipologia di installazione soddisfa le necessità funzionali indicate dal committente.
L'impianto è situato all'esterno ed all'interno del reparto ed è di tipo industriale stagno, tutti i componenti utilizzati saranno idonei per ambiente industriale in esecuzione stagna IP55 minimo e in ambiente non classificato ai fini ATEX.
I cavi impiegati saranno idonei per posa in canaline, tubi corrugati interrati e tubi flessibili spiralati tipo Teaflex.

3 - NORME DI RIFERIMENTO

Gli impianti sono rispondenti alle norme e leggi vigenti con particolare riferimento alle seguenti:

Guida CEI 0-2 Guida per la definizione della documentazione di progetto degli imp. elettrici

CEI 64-8: Impianti elettrici utilizzatori a tensione nominale non superiore a 1000V in corrente alternata e a 1500V in corrente continua.

CEI 11-17 Impianti di produzione, trasmissione e distribuzione di energia elettrica. Linee in cavo.

CEI EN 61439-1 Apparecchiature assiemate di protezione e di manovra per bassa tensione (quadri BT). Parte 1: Regole Generali.

CEI EN 61439-2 Apparecchiature assiemate di protezione e di manovra per bassa tensione (quadri BT). Parte 2: Quadri di potenza.

Tabelle CEI Unel Relative a cavi per energia con conduttori in rame con isolante elastomerico o termoplastico ed aventi grado di isolamento non superiore a 4. Tabelle n° 35011, 35023, 35024/1, 35026

DM 37/08 Regolamento concernente l'attuazione dell'articolo 11-quaterdecis, comma 13, lettera a) della legge n. 248 del 02/12/2005

Legge n°186 del 01/03/1968 Disposizioni concernenti la produzione di materiali, apparecchiature, macchinari, installazioni e impianti elettrici ed

elettronici.

DLgs 81/08 Testo unico sulla salute e sicurezza sul lavoro

4 -DESCRIZIONE DEGLI IMPIANTI

4.1 – LOGICA DI FUNZIONAMENTO E SEGNALAZIONE

La logica del sistema di controllo e segnalazione perdite è basata sulla rivelazione del sensore di alto livello (livellostato) che, alla presenza di perdite e sversamenti nel contenimento o nella canaletta, segnala tramite apertura di un contatto libero da tensione, il verificarsi della condizione.

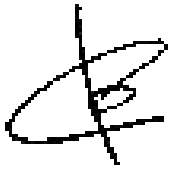
Tale segnalazione è presente anche in caso di mancanza di tensione, malfunzionamento dello strumento o interruzione dei cavi.

La logica di segnalazione è quindi la seguente:

Nessuna Perdita, strumento funzionante e cablaggi OK		Contatto Chiuso
Segnalazione Perdita Combustibile		Apertura Contatto
Interruzione Cablaggi		Apertura Contatto
Mancanza Tensione e Alimentazione strumenti		Apertura contatto

Tutti i contatti sono disponibili nelle relative morsettiere presenti nei quadri di alimentazione e devono essere collegati al sistema di segnalazione del cliente. (a carico del cliente).

Sulla portina del quadro sono presenti due segnalazioni luminose, una bianca per la presenza tensione 230V 50 Hz., una blu per la presenza tensione 24V CC.



4.2 - CAVI E VIE CAVI

Le condutture utilizzate e installate sono quelle evidenziate nella documentazione allegata (Schemi elettrici e planimetrie)

La posa dei cavi è stata effettuata in tubazioni corrugate interrate predisposte, tra i livellostati e i quadri di alimentazione e in tubo tipo conduit per alcuni collegamenti locali dei quadri.

I cavi impiegati sono non propaganti l'incendio secondo CEI 20-22, di tipo multipolare FG16OR16 a Norma CPR.

Per le altre caratteristiche consultare il relativo datasheet.

La tipologia, formazione e la quantità dei cavi da utilizzare è riportata nell'apposito elenco cavi.

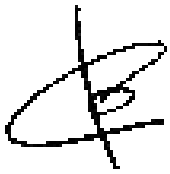
La colorazione dei conduttori di neutro e di protezione dovrà essere in accordo con la norma CEI 16-4, la combinazione bicolore giallo-verde deve essere usata per individuare il conduttore di protezione e per nessun altro scopo, il colore blu esclusivamente per il conduttore di neutro.

Le aree di processo non sono da considerare classificate ai fini ATEX e gli impianti devono essere idonei per ambienti industriali stagni con grado di protezione richiesto e pertanto la distribuzione, le cassette, relativi pressacavi e tutti i componenti elettrici dovranno essere idonei per questo tipo di installazione.

4.3 - COLLEGAMENTI DI TERRA STRUMENTAZIONE

I collegamenti di terra della strumentazione sono stati effettuati, per ogni singolo strumento, tramite corda di rame isolata di sezione 6 mm2 in PVC (FS17) di colore Giallo/ Verde collegata ai collettori di terra locali già esistenti.

Il quadro di alimentazione è stato collegato a terra tramite il relativo conduttore del cavo di alimentazione.



5 – PRESCRIZIONI GENERALI PER LA SICUREZZA

Gli impianti sono stati realizzati nel rispetto delle vigenti norme CEI, con particolare riferimento ai punti descritti nella presente relazione.

6 - MATERIALI

I materiali utilizzati sono di primaria marca, dotati ove previsto di marchio IMQ (o altre certificazioni ammesse dalla legge), rispondenti alle norme CEI generali e specifiche di prodotto.

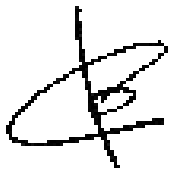
7 - VERIFICHE

Al termine dei lavori sono state eseguite tutte le verifiche prescritte dalla normativa vigente, con specifico riferimento a CEI 64-8/6 e sono state eseguite le prove funzionali.

Per verificare il corretto funzionamento nel tempo dei rilevatori di perdita, periodicamente devono essere testati (con cadenza almeno semestrale) simulando una perdita con un recipiente contenente acqua e verificando l'effettivo intervento, così come verificare la pulizia dei sensori da sostanze estranee che potrebbero portare a false rivelazioni.

6 – ALLEGATI

La presente relazione tecnica va consultata unitamente a tutti gli elaborati di cui all'elenco a pagina 2.



ELENCO CAVI ELETTRICI

www.pradatec.com	CLIENTE - *Client* **IMPIANTI ENERGIA**	Commessa - *Job* **609**	Unità - *Unit* **--**
	LOCALITÀ - *Plant Location* **SETTIMO M.SE (MI)**	SPC N° **609-IICL-004**	
	PROGETTO - *Project* **ENERIA CAT - DC L07**	Fg. - Sh. di - of **1** **2**	Rev. **0**

ELENCO CAVI CONTROLLO

Rev.	Descrizione - *Description*	Elab. - *Prep'd*	Verif. - *Chk'd*	Appr. - *App'd*	Data - *Date*
0	Prima Emissione	31/03/2023	COGI	COGI	PRO

www.pradatec.com

ELENCO CAVI ENERGIA E CONTROLLO

Rev.	Descrizione	Data	Disegnato	Controllato	Approvato
3					
2					
1					
0	1.ma emissione	31/03/2023	COGI	COGI	PRCE

Numero Documento Doc.No. **609-IICL-004**

Progetto *Job.No.* | **Area** *Area* | **Foglio** *Sheet* 2 di 2

CLIENTE *Customer*: **IMPIANTI ENERGIA**

IMPIANTO *Plant*: **ENERIA CAT - DC L07**

LOCALITA' *Location*: **SETTIMO M.SE (MI)**

SIGLA	PARTENZA	ARRIVO	SERVIZIO	DATI CAVO					NOTE
				formazione	tipo	diametro (mm)	lunghezza tratta (mt)	posato	
LSH-01	QE-01	LSH-01	Livellostato perdite pozzetto esterno GE-F	5x1,5 mm2	FG16OR16	11,7	48	Tubo corrugato	
LSH-02	QE-01	LSH-02	Livellostato perdite pozzetto esterno GE-E	5x1,5 mm2	FG16OR16	11,7	32	Tubo corrugato	
LSH-03	QE-01	LSH-03	Livellostato perdite pozzetto esterno GE-B	5x1,5 mm2	FG16OR16	11,7	6	Tubo corrugato	
LSH-04	QE-01	LSH-04	Livellostato perdite pozzetto esterno GE-A	5x1,5 mm2	FG16OR16	11,7	32	Tubo corrugato	
LSH-05	QE-01	LSH-05	Livellostato perdite zona cordolata e caditoia interna gruppo elettrogeno "F"	5x1,5 mm2	FG16OR16	11,7	48	Tubo corrugato	
LSH-06	QE-01	LSH-06	Livellostato perdite zona cordolata e caditoia interna gruppo elettrogeno "E"	5x1,5 mm2	FG16OR16	11,7	32	Tubo corrugato	
LSH-07	QE-01	LSH-07	Livellostato perdite zona cordolata e caditoia interna gruppo elettrogeno "B"	5x1,5 mm2	FG16OR16	11,7	6	Tubo corrugato	
LSH-08	QE-01	LSH-08	Livellostato perdite zona cordolata e caditoia interna gruppo elettrogeno "A"	5x1,5 mm2	FG16OR16	11,7	32	Tubo corrugato	
LSH-09	QE-01	LSH-09	Livellostato perdite pozzetto esterno serbatoio S 1	5x1,5 mm2	FG16OR16	11,7	28	Tubo corrugato	
LSH-10	QE-01	LSH-10	Livellostato perdite pozzetto esterno serbatoio S 2	5x1,5 mm2	FG16OR16	11,7	28	Tubo corrugato	
LSH-11	QE-01	LSH-11	Livellostato perdite pozzetto esterno serbatoio S 5	5x1,5 mm2	FG16OR16	11,7	24	Tubo corrugato	
LSH-12	QE-01	LSH-12	Livellostato perdite pozzetto esterno serbatoio S 6	5x1,5 mm2	FG16OR16	11,7	24	Tubo corrugato	
LSH-13	QE-02	LSH-13	Livellostato perdite pozzetto esterno GE-H	5x1,5 mm2	FG16OR16	11,7	25	Tubo corrugato	
LSH-14	QE-02	LSH-14	Livellostato perdite pozzetto esterno GE-G	5x1,5 mm2	FG16OR16	11,7	30	Tubo corrugato	
LSH-15	QE-02	LSH-15	Livellostato perdite pozzetto esterno GE-D	5x1,5 mm2	FG16OR16	11,7	58	Tubo corrugato	
LSH-16	QE-02	LSH-16	Livellostato perdite pozzetto esterno GE-C	5x1,5 mm2	FG16OR16	11,7	72	Tubo corrugato	
LSH-17	QE-02	LSH-17	Livellostato perdite zona cordolata e caditoia interna gruppo elettrogeno "H"	5x1,5 mm2	FG16OR16	11,7	25	Tubo corrugato	
LSH-18	QE-02	LSH-18	Livellostato perdite zona cordolata e caditoia interna gruppo elettrogeno "G"	5x1,5 mm2	FG16OR16	11,7	30	Tubo corrugato	
LSH-19	QE-02	LSH-19	Livellostato perdite zona cordolata e caditoia interna gruppo elettrogeno "D"	5x1,5 mm2	FG16OR16	11,7	58	Tubo corrugato	
LSH-20	QE-02	LSH-20	Livellostato perdite zona cordolata e caditoia interna gruppo elettrogeno "C"	5x1,5 mm2	FG16OR16	11,7	72	Tubo corrugato	
LSH-21	QE-02	LSH-21	Livellostato perdite pozzetto esterno serbatoio S 3	5x1,5 mm2	FG16OR16	11,7	36	Tubo corrugato	
LSH-22	QE-02	LSH-22	Livellostato perdite pozzetto esterno serbatoio S 4	5x1,5 mm2	FG16OR16	11,7	36	Tubo corrugato	
LSH-23	QE-02	LSH-23	Livellostato perdite pozzetto esterno serbatoio S 7	5x1,5 mm2	FG16OR16	11,7	48	Tubo corrugato	
LSH-24	QE-02	LSH-24	Livellostato perdite pozzetto esterno serbatoio S 8	5x1,5 mm2	FG16OR16	11,7	48	Tubo corrugato	
LSH-01-24	Barra di terra in campo	LSH-01-24 - morsetto terra	Collegamento equipotenziale/messa a terra strumenti in campo	1x6 mm2	FS-17 (GV)	4,6	240	Canalina/conduit	per 24 strumenti
QE-01	QE-01	Interruttore predisposto alimentazione 230V	Alimentazione Quadro QE-1	3G1,5 mm2	FG16OR16	10,1	20	Tubo corrugato / canlina in rete	
QE-02	QE-02	Interruttore predisposto alimentazione 230V	Alimentazione Quadro QE-2	3G1,5 mm2	FG16OR16	10,1	20	Tubo corrugato / canlina in rete	

NOTA: Le lunghezze dei cavi sono indicative e vanno verificate con le reali condizioni di posa dei cavi.

SCHEMA ELETTRICO

QUADRI ALIMENTAZIONE LIVELLOSTATI

SISTEL
WE PROJECT ENERGY

VIA COMO 29
SOLARO (MI)
Tel. 02-49621156

Raccolta Schemi e Disegni

Cliente:

Impianto CASSETTA ALIMENTAZIONE STRUMENTI

Nr. Pratica

Data: 10.08.2022

Elaboratore: VALTORTA F.

Controllato:

Approvato:

Data Emissione:

Totale fogli: 8

REVISIONE: "---"
REVISIONE: "---"
REVISIONE: "00-PRELIMINARE-10/08/2022-V.F."

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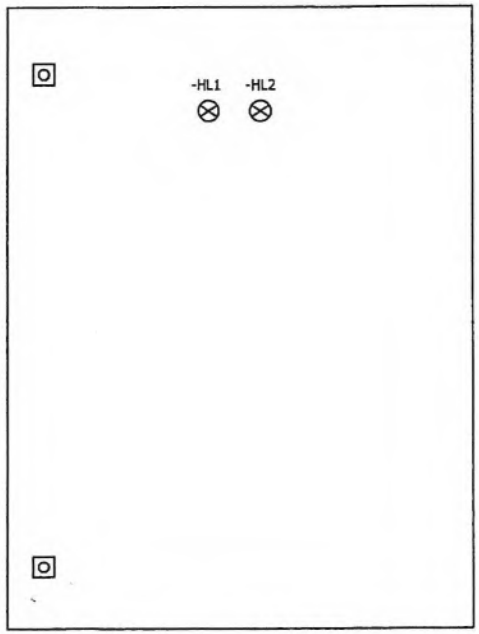

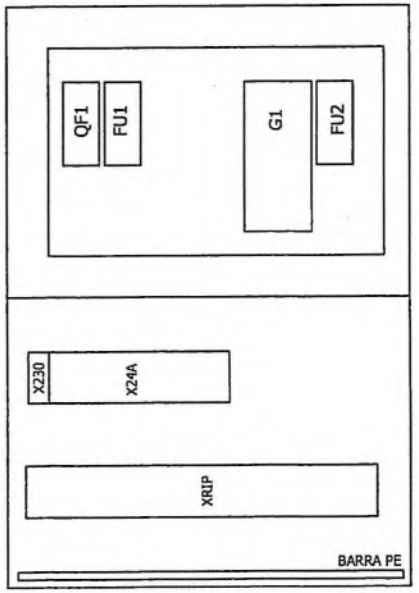

RIALZARE MORSETTIERA
PER PASSAGGIO CAVI

CASSETTA INOX
IP65
PROFONDITA' 210mm

Settore: =QAST-A-3
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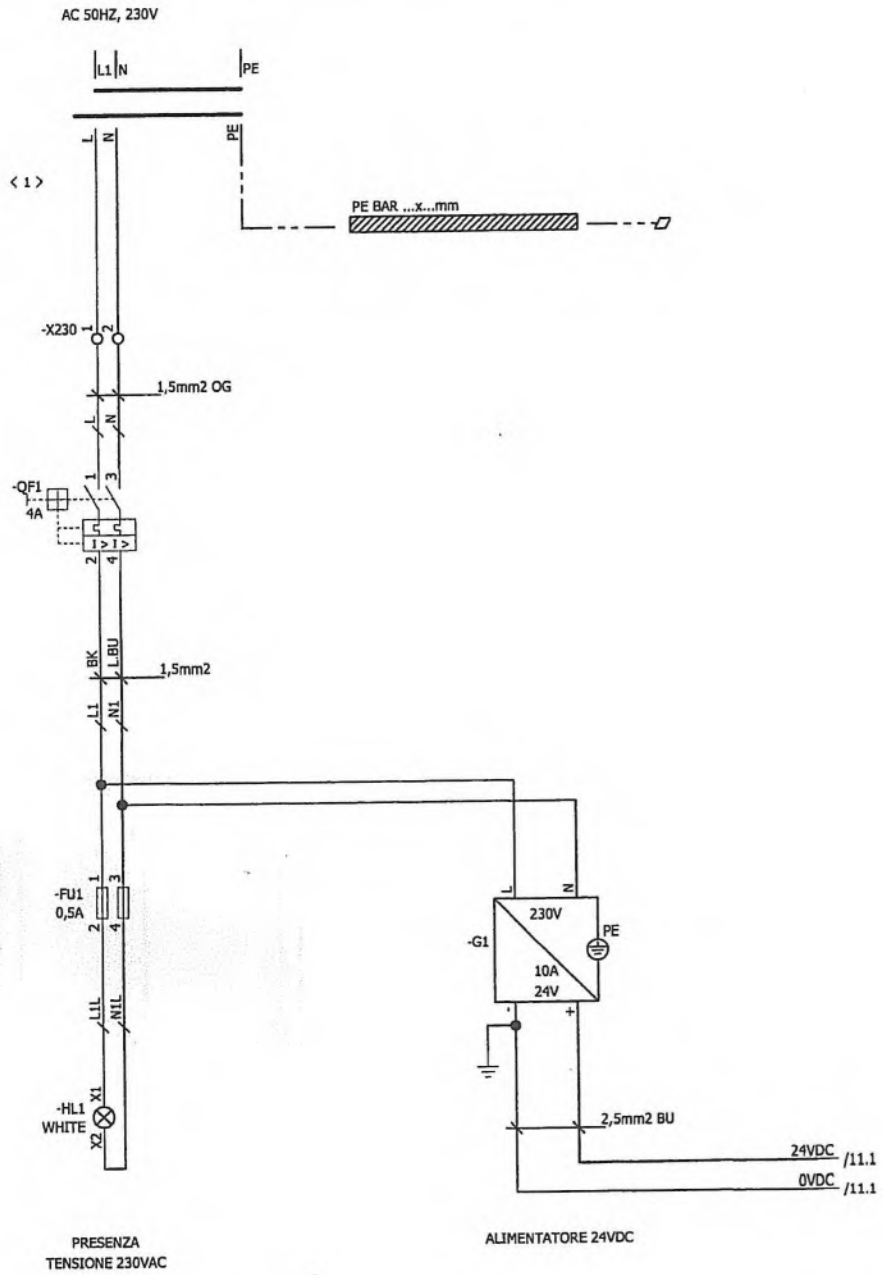

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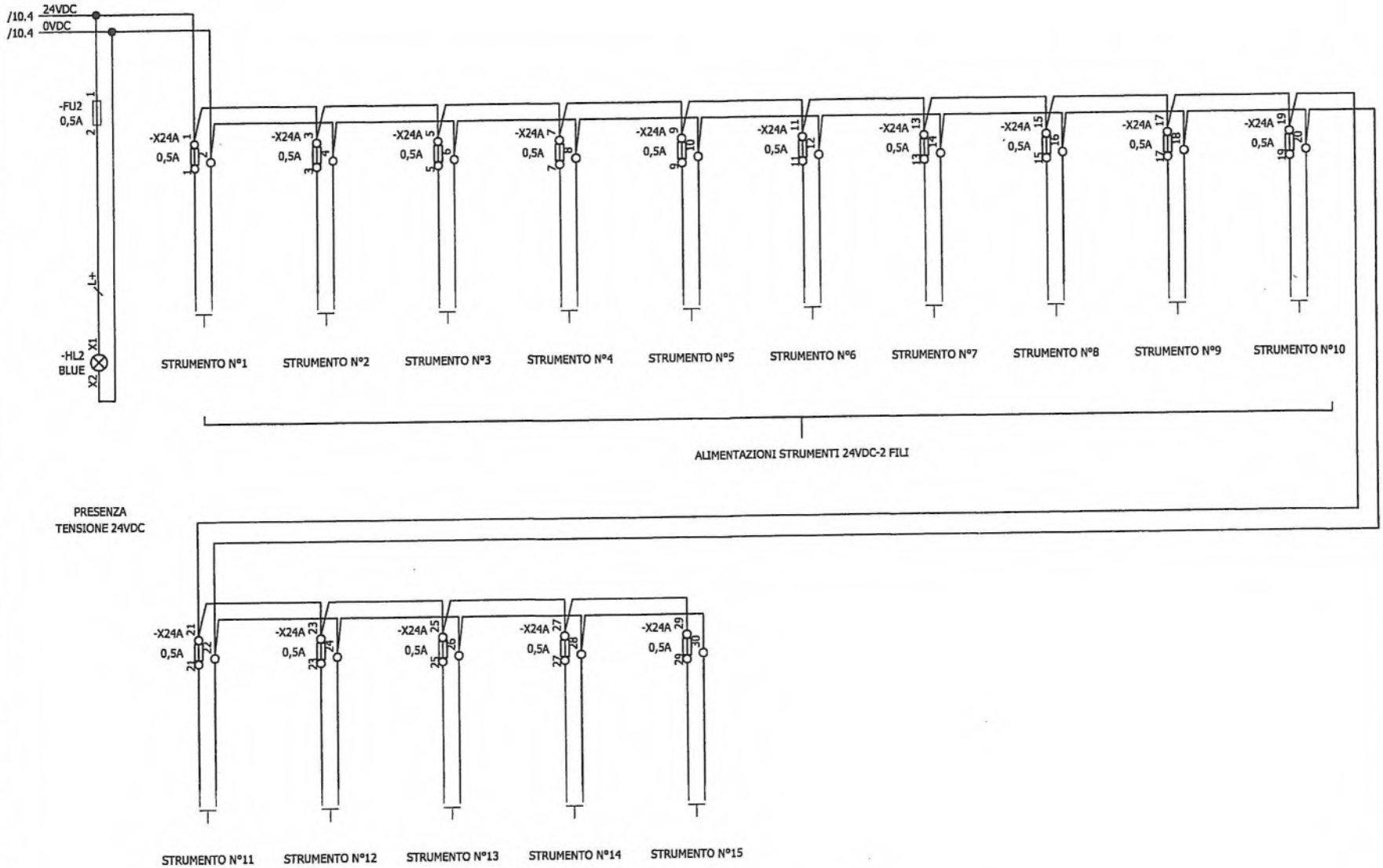

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00	PRELIMINARE	10/08/2022	V.F.	Contr.		CASSETTA ALIMENTAZIONE STRUMENTI	

SISTEL

ALIMENTAZIONI 24VDC STRUMENTI

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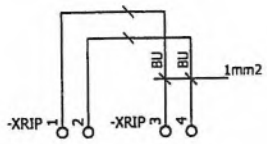
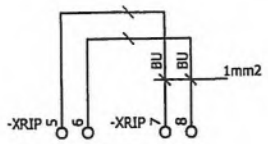
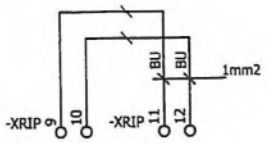


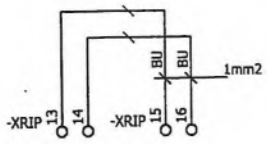
MORSETTIERA DI APPOGGIO
SEGNALE DA STRUMENTO 1
A SUPERVISIONE



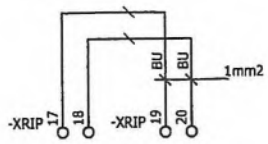
MORSETTIERA DI APPOGGIO
SEGNALE DA STRUMENTO 2
A SUPERVISIONE



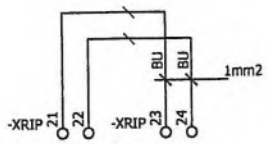
MORSETTIERA DI APPOGGIO
SEGNALE DA STRUMENTO 3
A SUPERVISIONE



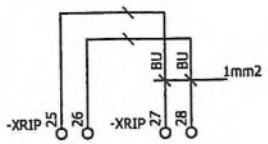
MORSETTIERA DI APPOGGIO
SEGNALE DA STRUMENTO 4
A SUPERVISIONE



MORSETTIERA DI APPOGGIO
SEGNALE DA STRUMENTO 5
A SUPERVISIONE



MORSETTIERA DI APPOGGIO
SEGNALE DA STRUMENTO 6
A SUPERVISIONE



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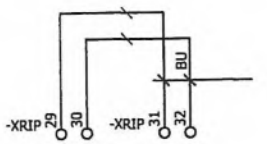
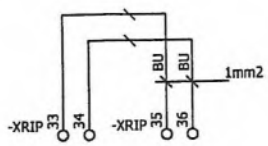
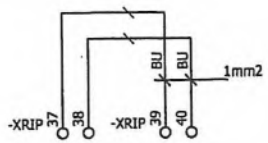
SEGNALE DA STRUMENTO 7
A SUPERVISIONE



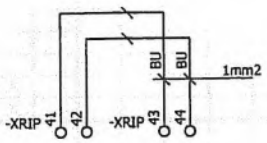
MORSETTIERA DI APPOGGIO
SEGNALE DA STRUMENTO 8
A SUPERVISIONE



MORSETTIERA DI APPOGGIO
SEGNALE DA STRUMENTO 9
A SUPERVISIONE



MORSETTIERA DI APPOGGIO
SEGNALE DA STRUMENTO 10
A SUPERVISIONE



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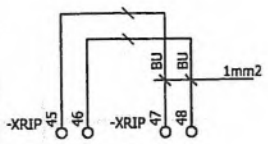

MORSETTIERA DI APPOGGIO
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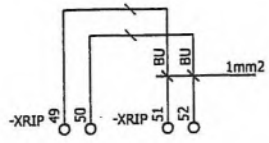
A SUPERVISIONE



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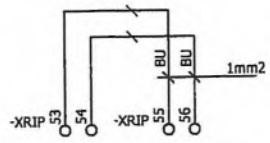
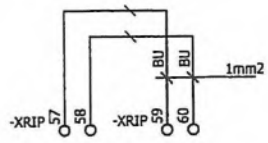
SEGNALE DA STRUMENTO 13
A SUPERVISIONE



MORSETTIERA DI APPOGGIO
SEGNALE DA STRUMENTO 14
A SUPERVISIONE



MORSETTIERA DI APPOGGIO
SEGNALE DA STRUMENTO 15
A SUPERVISIONE

No.
< >

100

Settore: =QAST-.D-12
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			Data	10.08.2022		MORSETTI DI APPOGGIO SEGNALI	=QAST.D
			Dis.	VALTORTA F.			+
PRELIMINARE	10/08/2022	V.F.	Contr.		CASSETTA ALIMENTAZIONE STRUMENTI	22 C-94	2894-22-00	Foglio 12 Segue

SISTEL

1	2	3	4	5	6	7	8
Cable name Denominazione cavo		Terminal/Morsetto	Terminal Type/Tipo mors.	Terminalboard Morsettiera	General notes/Note generali:		Cable name Denominazione cavo
		Klemme : 1-2	WDU 2.5				

				External destination/Destinazione esterna		Terminal nr. Morsetto nr.	Metal bridges Ponti metallici Comment Commento	Wired bridges Ponti a filo	Location Locazione	Internal destination/Destinazione interna								
				Plant,Function,Location,ID Impianto,Funzione,Luogo,Tnf	Pin Attacco					Plant Impianto	Function Funzione	Location Luogo	ID TNF	Pin Attacco				
						Morsettiera: -X230												
						Nr. Morsetti: 2												
	X			-TD	L	1			/10.1				-QF1	1	L			
	X			-TD	N	2			/10.2				-QF1	3	N			

N-Sbarra:
PE-Sbarra:

Segue vedi foglio:

Progetto: 2894-22

Settore: =QAST-X-15

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			Data					=QAST.X	
			Dis.	VALTORTA F.					
0	PRELIMINARE	10/08/2022	V.F.	Contr.	CASSETTA ALIMENTAZIONE STRUMENTI	SISTEL	=QAST.D-X230 Morsettiera	22 C-94	2894-22-00	Foglio 15 Segue 16

Anschlußplan

1	2	3	4	5	6	7	8

Cable name / Denominazione cavo

Terminal/Morsetto — Klemme : 1-30

Terminal Type/Tipo mors.

External destination/Destinazione esterna

Plant,Function,Location,ID / Impianto,Funzione,Luogo,Tnf

Pin / Attacco

Terminalboard / Morsettiera

Terminal nr. / Morsetto nr.

Metal bridges / Ponti metallici

Comment / Commento

Wired bridges / Ponti a filo

Location / Locazione

Morsettiera: -X24A

Nr. Morsetti: 30

1			/11.2
2			/11.2
3			/11.2
4			/11.2
5			/11.3
6			/11.3
7			/11.3
8			/11.3
9			/11.4
10			/11.4
11			/11.5
12			/11.5
13			/11.5
14			/11.5
15			/11.6
16			/11.6
17			/11.6
18			/11.6
19			/11.7
20			/11.7
21			/11.2
22			/11.2
23			/11.2
24			/11.2
25			/11.3
26			/11.3
27			/11.3
28			/11.3
29			/11.4
30			/11.4

General notes/Note generali:

Cable name / Denominazione cavo

Internal destination/Destinazione interna

Plant / Impianto	Function / Funzione	Location / Luogo	ID / TNF	Pin / Attacco
			-G1	+
			-G1	-

N-Sbarra:

PE-Sbarra:

Segue vedi foglio:

			Data				
			Dis.	VALTORTA F.			
LIMINARE	10/08/2022	V.F.	Contr.		CASSETTA ALIMENTAZIONE STRUMENTI	SISTEL	=QAST.D-X24A

=QAST.X

22 C-94 | 2894-22-00 | Foglio 16 | Segue 17

1	2	3	4	5	6	7	8
Cable name Denominazione cavo		Terminal/Morsetto Klemme : 1-40	Terminal Type/Tipo mors. WDU 2.5	Terminalboard Morsettiera	General notes/Note generali:		Cable name Denominazione cavo

External destination/Destinazione esterna		Terminal nr. Morsetto nr.	Metal bridges Ponti metallici	Comment Commento	Wired bridges Ponti a filo	Location Locazione	Internal destination/Destinazione interna				
Plant,Function,Location,ID Impianto,Funzione,Luogo,Tnf	Pin Attacco						Plant Impianto	Function Funzione	Location Luogo	ID TNF	Pin Attacco
		Morsettiera: -XRIP Nr. Morsetti: 60									
		1			/12.1						
		2			/12.1						
		3			/12.1						
		4			/12.2						
		5			/12.2						
		6			/12.2						
		7			/12.3						
		8			/12.3						
		9			/12.4						
		10			/12.4						
		11			/12.4						
		12			/12.4						
		13			/12.5						
		14			/12.5						
		15			/12.5						
		16			/12.5						
		17			/12.6						
		18			/12.6						
		19			/12.7						
		20			/12.7						
		21			/12.1						
		22			/12.1						
		23			/12.1						
		24			/12.2						
		25			/12.2						
		26			/12.2						
		27			/12.3						
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		31			/12.4						
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		34			/12.5						
		35			/12.5						
		36			/12.5						
		37			/12.6						
		38			/12.6						
		39			/12.7						
		40			/12.7						
		N-Sbarra:									
		PE-Sbarra:									

Segue vedi foglio:

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Settore: =QAST-.X-17

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				Dis.	VALTORTA F.					
0	PRELIMINARE	10/08/2022	V.F.	Contr.		CASSETTA ALIMENTAZIONE STRUMENTI	SISTEL	=QAST.D-XRIP		Foglio 17
s.	Modifica	Data	Nome	Norm		Ric. da:	Sost.:	Morsettiera	Anschlußplan	22 C-94	2894-22-00	Segue 18

FB: MORSETTIERA-CS1

1	2	3	4	5	6	7	8
Cable name Denominazione cavo		Terminal/Morsetto Klemme : 41-60	Terminal Type/Tipo mors. WDU 2.5	Terminalboard Morsettiera	General notes/Note generali:	Cable name Denominazione cavo	
		External destination/Destinazione esterna Plant,Function,Location,ID Impianto,Funzione,Luogo,Tnf	Pin Attacco	Terminal nr. Morsetto nr. / Metal bridges Ponti metallici / Comment Commento / Wired bridges Ponti a filo / Location Locazione	Internal destination/Destinazione interna Plant Impianto / Function Funzione / Location Luogo / ID TNF / Pin Attacco		
				Morsettiera: -XRIP Nr. Morsetti: 60			
				41 /12.1 42 /12.1 43 /12.1 44 /12.2 45 /12.2 46 /12.2 47 /12.3 48 /12.3 49 /12.4 50 /12.4 51 /12.4 52 /12.4 53 /12.5 54 /12.5 55 /12.5 56 /12.5 57 /12.6 58 /12.6 59 /12.7 60 /12.7		
		N-Sbarra:					
		PE-Sbarra:					
					Segue vedi foglio:		

Progetto: 2894-22

data Standard: 02.1997
Settore: =QAST-.X-18
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				Dis.	VALTORTA F.		
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SISTEL

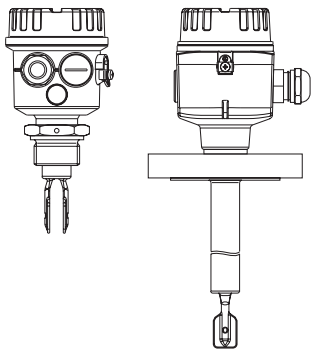
22.C.04 2894.22.00

MANUALE LIVELLOSTATI

Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Operating Instructions

Liquiphant M FTL50, FTL51



de – Grenzschalter
en – Point Level Switch
fr – Détecteur de niveau
es – Detector de nivel
it – Interruttore di livello
nl – Niveauschakelaar

KA143F/00/a6/07.10
71118926

Endress+Hauser
People for Process Automation

de - Inhalt

Sicherheitshinweise	4
Behandlung	6
Geräte-Identifikation	8
Verwendung	14
Messeinrichtung	15
Einbau	19
Einstellungen	28
Lichtsignale	32
Anschluss	33
Wartung, Reinigung	54
Technische Daten	55
Zubehör	57
Fehlersuche	60
Ersatzteile	68
Reparatur	69
Ergänzende Dokumentation	73

en - Contents

Notes on Safety	4
Handling	6
Device Identification	8
Application	14
Measuring system	15
Installation	19
Setting-up	28
Light signals	32
Connections	33
Maintenance, Cleaning	54
Technical Data	55
Accessories	57
Trouble-shooting	61
Spare parts	68
Repair	69
Supplementary Documentation	73

fr - Sommaire

Conseils de sécurité	4
Manipulation	6
Dénomination	8
Utilisation	14
Ensemble de détection de niveau	15
Montage	19
Réglage	28
Signaux lumineux	32
Raccordement	33
Entretien, Nettoyage	54
Caractéristiques techniques	55
Accessoires	57
Recherche de défauts	62
Pièces de rechange	68
Réparations	69
Documentation complémentaire	73

Achtung!
= verboten;
führt zu fehlerhaftem Betrieb oder Zerstörung.

Caution!
= forbidden;
leads to incorrect operation or destruction.

Attention!
= interdit; peut provoquer des dysfonctionnements ou la destruction.

es - Indice

Notas sobre seguridad	5
Modo de empleo	6
Identificación del equipo	8
Aplicación	14
Sistema de medida	15
Montaje	19
Ajuste	28
Señales luminosas	32
Conexiones	33
Mantenimiento, Limpieza	54
Datos técnicos	55
Accesorios	57
Identificación de fallos	63
Repuestos	68
Reparaciones	69
Documentación suplementaria	70

it - Indice

Note sulla sicurezza	5
Accorgimenti	6
Identificazione dello strumento	8
Applicazione	14
Sistema di misura	15
Montaggio	19
Messa in servizio	28
Segnali luminosi	32
Collegamenti elettrici	33
Manutenzione, Pulizia	54
Dati tecnici	55
Accessori	57
Individuazione e eliminazione delle anomalie	64
Ricambi	68
Riparare	69
Documentazione supplementare	70

nl - Inhoud

Veiligheidsinstructies	5
Behandeling	6
Instrument- identificatie	8
Toepassing	14
Meetopstelling	15
Inbouw	19
Instellingen	28
Lichtsignalen	32
Aansluiting	33
Onderhoud, Reiniging	54
Technische gegevens	55
Toebehoren	57
Fout zoeken	65
Reserve-onderdelen	68
Reparatie	69
Aanvullende documentatie	70

Atención!
= Prohibido; peligro de mal funcionamiento o de destrucción.

Attenzione!
= Vietato; pericolo di malfunzionamento o di distruzione.

Opgelet!
= verboden; leidt tot foutieve werking of storing.

de – Sicherheitshinweise

Der Liquiphant M FTL50, FTL51 darf nur als Grenzschalter für Flüssigkeiten verwendet werden.
Bei unsachgemäßem Einsatz können Gefahren von ihm ausgehen.
Das Gerät darf **nur von qualifiziertem und autorisiertem Fachpersonal** unter strenger Beachtung dieser Betriebsanleitung, der einschlägigen Normen, der gesetzlichen Vorschriften und der Zertifikate (je nach Anwendung) eingebaut, angeschlossen, in Betrieb genommen und gewartet werden.
In der Gebäudeinstallation ist ein Netzschalter für das Gerät leicht erreichbar in dessen Nähe zu installieren.
Er ist als Trennvorrichtung für das Gerät zu kennzeichnen.

en – Notes on Safety

The Liquiphant M FTL50, FTL51 is designed for point level detection in liquids.
If used incorrectly it is possible that application-related dangers may arise.
The level limit switch Liquiphant M FTL50, FTL51 may be installed, connected, commissioned, operated and maintained **by qualified and authorised personnel only**, under strict observance of these operating instructions, any relevant standards, legal requirements, and, where appropriate, the certificate.
Install an easily accessible power switch in the proximity of the device.
Mark the power switch as a disconnector for the device.

fr – Conseils de sécurité

Le Liquiphant M FTL50, FTL51 doit être exclusivement utilisé comme détecteur de niveau pour liquides.
Il peut être source de danger en cas d'utilisation non conforme aux prescriptions.
L'appareil ne doit être installé, raccordé, mise en service et entretenu **que par un personnel qualifié et autorisé**, qui tiendra compte des indications contenues dans la présente mise en service, des normes en vigueur et des certificats disponibles (selon l'application).
Installer un commutateur réseau à proximité immédiate de l'appareil, en veillant à ce qu'il soit facilement accessible.
Marquer ce commutateur comme prise de coupure de l'appareil.

es - Notas sobre seguridad

El detector de nivel Liquiphant M FTL50, FTL51 ha sido diseñado para la detección de límite en fluidos.
Su empleo inapropiado puede resultar peligroso.
El equipo deberá ser montado, conectado, instalado y mantenido **única y exclusivamente por personal cualificado y autorizado**, bajo rigurosa observación de las presentes instrucciones de servicio, de las normativas y legislaciones vigentes, así como de los certificados (dependiendo de la aplicación).
Instalar un interruptor de fácil acceso en las proximidades del equipo.
Identificar el interruptor como desconectador del equipo.

it - Note sulla sicurezza

Il Liquiphant M FTL50, FTL51 è particolarmente studiato per l'impiego come soglia di livello in liquidi.
Un'installazione non corretta può determinare pericolo.
Lo strumento può essere montato **solamente da personale qualificato ed autorizzato**.
La messa in esercizio e la manutenzione devono rispettare le indicazioni di collegamento, le norme e i certificati di seguito riportati.
Installare un interuttore per l'alimentazione in prossimità del dispositivo.
Marcare l'interuttore come disconnessione del dispositivo.

nl - Veiligheidsinstructies

Gebruik de Liquiphant M FTL50, FTL51 alleen als niveauschakelaar voor vloeistoffen.
Indien niet correct gebruikt kunnen gevaarlijke situaties ontstaan.
Het instrument **alleen door gekwalificeerd en geautoriseerd personeel** laten inbouwen, aansluiten, in bedrijf nemen en onderhouden.
Neem de instructies in deze Inbedrijfstellingsvoorschriften, de desbetreffende normen, de wettelijke voorschriften en eventuele certificaten in acht.
Installeer een makkelijk bereikbare voedingschakelaar in de nabijheid van het instrument.
Kenmerk de voedingschakelaar specifiek voor het instrument.

de - Behandlung
Am Gehäuse, Flansch oder Verlängerungsrohr anfassen.

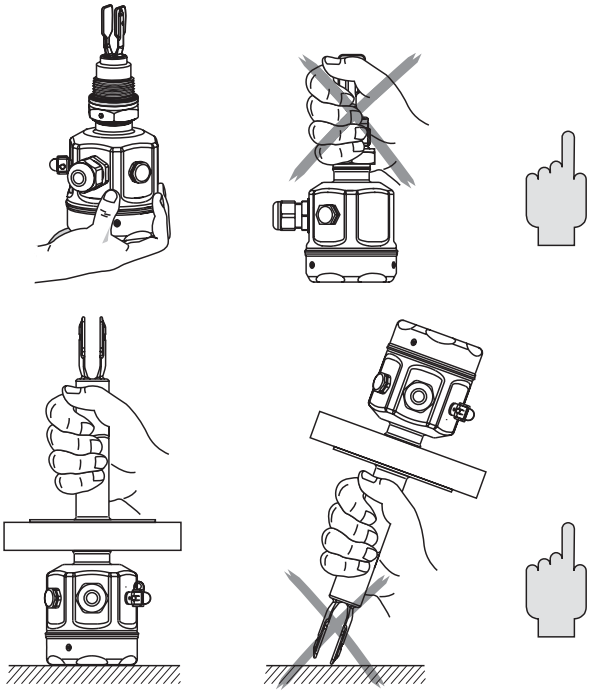
en - Handling
Hold by housing, flange or extension tube.

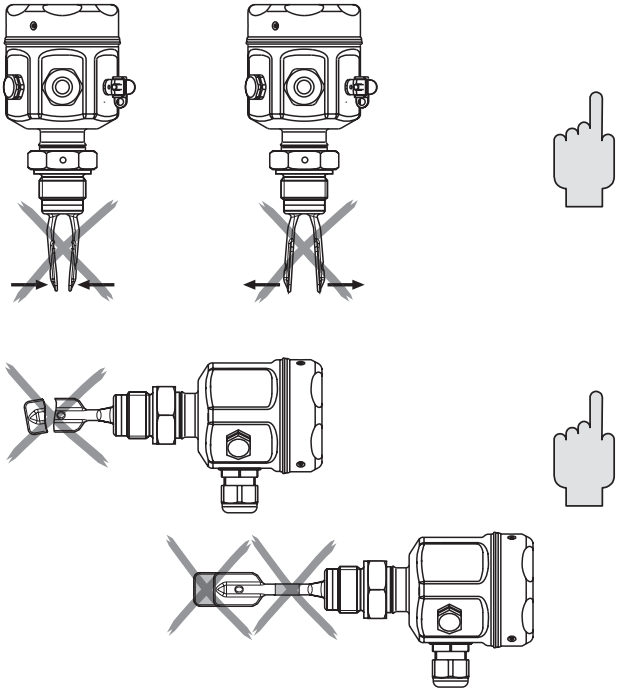
fr - Manipulation
Tenir par le boîtier, la bride ou le tube prolongateur.

es - Modo de empleo
Coger por el cabezal, brida o tubo de extensión.

it - Accorgimenti
Afferrare la custodia, per la flangia o per il tubo di estensione.

nl - Behandeling
Vastpakken via behuizing, flens of verlengbuis.





de – **Nicht** verbiegen
Nicht kürzen
Nicht verlängern

en – Do **not** bend
Do **not** shorten
Do **not** lengthen

fr – **Ne pas** déformer
Ne pas raccourcir
Ne pas rallonger

es – **No** torcer
No acortar
No alargar

it – **Non** stringere o allargare
Non accorciare o allungare
Non piegare

nl – **Niet** verbuigen
Niet inkorten
Niet verlengen

de - Geräte-Identifikation

en - Device Identification

fr - Dénomination

es - Identificación del equipo

it - Identificazione dello strumento

nl - Instrument-identificatie

ENDRESS+HAUSER
LIQUIPHANT M
Order Code
FTL5# ########## ##### mm
in
FTL51
L
A *1
B ATEX II 3 G EEx nC II T6, WHG
ATEX II 3 D T85°C*3
C ATEX II 3 G EEx nA II T6, WHG
ATEX II 3 D T85°C*3
D *1 WHG
E ATEX II 1/2 G EEx de IIC T6, WHG
F ATEX II 1/2 G EEx ia IIC T6, WHG
ATEX II 1/2 D T80°C*3
G ATEX II 1/2 G EEx ia IIC T6
ATEX II 1/2 D T80°C*3
H ATEX II 1 G EEx ia IIC T6
I ATEX II 1/2 G EEx de IIC T6
J ATEX II 1 G EEx ia IIC T6, WHG
K ATEX II 1/2 G EEx d IIC T6
L ATEX II 1/2 G EEx d IIC T6, WHG
M NEPSI Ex ia IIC T6
N NEPSI Ex d IIC T6
P FM IS, Cl. I, II, III, Div. 1, Gr. A-G
Q FM XP, Cl. I, II, III, Div. 1, Gr. B-G, E5 => Gr. A-G
R FM NI, Cl. I, Div. 2, Gr. A-D
S CSA IS, Cl. I, II, III, Div. 1, Gr. A-G
T CSA XP, Cl. I, II, III, Div. 1, Gr. A-G
U CSA General purpose
V TIIS Ex ia IIC T3
W TIIS Ex d IIB T3
X TIIS Ex ia IIC T6
7 TIIS Ex d IIC T3
8 TIIS Ex d IIC T6
Y *2
KA163
KA163

A##	Flansche / Flanges / Brides / Brida / Flangia / Flens	→ 12 13	
B##			
C##			
D##			
F##			
K##			
N##			
GE2	R ¾, DIN 2999, 316L		max. 100 bar, 150 °C
GE5	R ¾, DIN 2999, AlloyC4		
GE6	R ¾, DIN 2999, AlloyC22		
GF2	R 1, DIN 2999, 316L		
GF5	R 1, DIN 2999, AlloyC4		
GF6	R 1, DIN 2999, AlloyC22		
GM2	NPT ¾, ANSI, 316L		
GM5	NPT ¾, ANSI, AlloyC4		
GM6	NPT ¾, ANSI, AlloyC22		
GN2	NPT 1, ANSI, 316L		
GN5	NPT 1, ANSI, AlloyC4		
GN6	NPT 1, ANSI, AlloyC22		
GQ2	G ¾, ISO 228, 316L		max. 100 bar, 150 °C
GQ5	G ¾, ISO 228, AlloyC4		
GQ6	G ¾, ISO 228, AlloyC22		
GR2	G 1, ISO 228, 316L		
GR5	G 1, ISO 228, AlloyC4		
GR6	G 1, ISO 228, AlloyC22		
GW2	G 1, ISO 228, 316L		max. 25 bar, 150 °C max. 40 bar, 100 °C
TC2	DN25-38 (1...1½"), ISO 2852, 316L Tri-Clamp		max. 16 bar, 120 °C max. 2 bar, 150 °C
TE2	DN40-51 (2"), ISO 2852, 316L Tri-Clamp		
YY9	*2		

10 11

*1 ohne / without / sans / sin / senza / zonder

*2 andere / others / autres / otros / altri / andere

*3 nicht gültig für PBT / not valid for PBT / non valable pour PBT / no es válido para PBT / non valido per PBT / niet geldig voor PBT

ENDRESS+HAUSER
LIQUIPHANT M

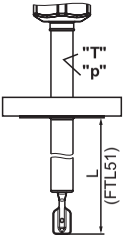
Order Code

FTL51

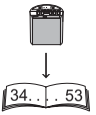
FTL5#_########## #### mm
in

L

AA	*[2],		Ra < 3.2 µm/80 grit (FTL50)
BB	..... mm,	316L,	Ra < 3.2 µm/80 grit
BE	..... mm,	AlloyC4,	Ra < 3.2 µm/80 grit
CB	..... in,	316L,	Ra < 3.2 µm/80 grit
CE	..... in,	AlloyC4,	Ra < 3.2 µm/80 grit
DB	"L II",	316L,	Ra < 3.2 µm/80 grit
DE	"L II",	AlloyC4,	Ra < 3.2 µm/80 grit
IA	*[2],		+ **"T"** (FTL50)
JB	..... mm,	316L	+ **"T"**
JE	..... mm,	AlloyC4	+ **"T"**
KB	..... in,	316L	+ **"T"**
KE	..... in,	AlloyC4	+ **"T"**
LB	"L II",	316L	+ **"T"**
LE	"L II",	AlloyC4	+ **"T"**
QA	*[2],		+ **"p"** (FTL50)
RB	..... mm,	316L	+ **"p"**
RE	..... mm,	AlloyC4	+ **"p"**
SB	..... in,	316L	+ **"p"**
SE	..... in,	AlloyC4	+ **"p"**
TB	"L II",	316L	+ **"p"**
TE	"L II",	AlloyC4	+ **"p"**
YY	*[2]		



A	FEL50A, PROFIBUS PA
1	FEL51, 19…253 V AC
2	FEL52, 10… 55 V DC, PNP
4	FEL54, 19…253 V AC, 19…55 V DC, DPDT
5	FEL55, 11… 36 V DC, 8/16 mA
6	FEL56, NAMUR, L-H
7	FEL57, PFM
8	FEL58, NAMUR, H-L
9	*[2]



E1	F27	NEMA6P,	NPT ¾	
E4	F16,	NEMA4X,	NPT ½	F16 (PBT)
E5	F13/17,	NEMA4X,	NPT ¾	
E6	F15,	NEMA4X,	NPT ½	
F1	F27,	IP68,	G ½	
F4	F16,	IP66,	G ½	F13/17 (Alu)
F5	F13/17,	IP66,	G ½	F27 (316L)
F6	F15,	IP66,	G ½	
G1	F27,	IP68,	M20	
G4	F16,	IP66,	M20	
G5	F13/17,	IP66,	M20	
G6	F15,	IP66,	M20	F15 (316L)
N4	F16,	IP66,	M12	
N5	F13/17,	IP66,	M12	
N6	F15,	IP66,	M12	
Y9	*2			

#3 Kompakt-Gehäuse / compact housing / boîtier compact / cabezal compacto / testa compatta / compacte behuizing → KA220

#7 Alu/sep. → KA163

A	*1
B	PVIS free
C	EN 10204 - 3.1, 316L
K	Spec. adjustment density H20
L	Spec. adjustment density H20, EN10204-3.1
N	EN 10204 - 3.1, NACE MR0175, 316L
P	100 bar (FTL51)
R	100 bar, EN 10204 - 3.1, NACE MR0175, 316L (FTL51)
S	GL/ABS marine certificate (FTL51: max. 1600 mm)
Y	*2

*1 ohne / without / sans / sin / senza / zonder

*2 andere / others / autres / otros / altri / andere

"L II" Schaltpunkt / Switchpoint / Point de commutation / Punto de conmutación / Punto di commutazione / Schakelpunt

Liquiphant II FTL 360/365, FDL 30/35

"T" Temperaturdistanzstück / Temperature spacer / Elément de refroidissement / Tramo disipador detemperatura / Distanziale per temperatura / Temperatuurreductiestuk

"p" Druckdichte Durchführung / Pressure sealed bushing / Entrée résistant à la pression / Extensión resistente a la presión / Passacavo a tenutadi pressione / Gasdichte doorvoering

de – Flansche

en – Flanges

fr – Brides

es – Brida

it – Flangia

nl – Flens

ANSI B 16.5

AA2	1¼",	150 lbs, RF,	316/316L
AB2	1¼",	300 lbs, RF,	316/316L (FTL51)
AC2	1½",	150 lbs, RF,	316/316L
AD2	1½",	300 lbs, RF,	316/316L (FTL51)
AE2	2",	150 lbs, RF,	316/316L
AE5	2",	150 lbs, RF,	AlloyC4 >316/316L
AE6	2",	300 lbs, RF,	Alloy C22 >316/316L
AF2	2",	300 lbs, RF,	316/316L
AG2	2",	600 lbs, RF,	316/316L (FTL51)
AJ2	2½",	300 lbs, RF,	316/316L (FTL51)
AL2	3",	150 lbs, RF,	316/316L
AM2	3",	300 lbs, RF,	316/316L (FTL51)
AN2	3",	600 lbs, RF,	316/316L (FTL51)
AP2	4",	150 lbs, RF,	316/316L
AQ2	4",	300 lbs, RF,	316/316L (FTL51)
AR2	4",	600 lbs, RF,	316/316L (FTL51)
A82	1",	150 lbs, RF,	316/316L

EN 1092-1

BA2	DN32,	PN6 A,	316L
BB2	DN32,	PN25/40 A,	316L
BC2	DN40,	PN6 A,	316L
BD2	DN40,	PN25/40 A,	316L
BE2	DN50,	PN6 A,	316L
BG2	DN50,	PN25/40 A,	316L
BH2	DN65,	PN6 A,	316L
BJ2	DN50,	PN100 A,	316L (FTL51)
BK2	DN65,	PN25/40 A,	316L
BM2	DN80,	PN10/16 A,	316L
BN2	DN80,	PN25/40 A,	316L
BQ2	DN100,	PN10/16 A,	316L
BR2	DN100,	PN25/40 A,	316L

B12	DN80,	PN100 A,	316L (FTL51)
B82	DN25,	PN25/40 A,	316L
CA2	DN32,	PN6 B1,	316L
CA5	DN32,	PN6,	AlloyC4 >316L
CA6	DN32,	PN6,	AlloyC22 >316L
CE2	DN50,	PN6 B1,	316L
CE5	DN50,	PN6,	AlloyC4 >316L
CE6	DN50,	PN6,	AlloyC22 >316L
CG2	DN50,	PN25/40 B1,	316L
CG5	DN50,	PN25/40,	AlloyC4 >316L
CG6	DN50,	PN25/40,	AlloyC22 >316L
CJ2	DN50,	PN100 B2,	316L (FTL51)
CN2	DN80,	PN25/40 B1,	316L
CN5	DN80,	PN25/40,	AlloyC4 >316L
CN6	DN80,	PN25/40,	AlloyC22 >316L
CQ2	DN100,	PN10/16 B1,	316L
CQ5	DN100,	PN10/16,	AlloyC4 >316L
CQ6	DN100,	PN10/16,	AlloyC22 >316L
C12	DN80,	PN100 B2,	316L (FTL51)
C82	DN25,	PN25/40 B1,	316L
C85	DN25,	PN25/40,	AlloyC4 >316L
C86	DN25,	PN25/40,	AlloyC22 >316L
DG2	DN50,	PN40 B1,	316L
DN2	DN80,	PN40 B1,	316L
D82	DN25,	PN40 B1,	316L
FG2	DN50,	PN40 C,	316L
NG2	DN50,	PN40 D,	316L

JIS B2220

KA2	10K 25,	RF,	316L
KC2	10K 40,	RF,	316L
KE2	10K 50,	RF,	316L
KE5	10K 50,	RF,	AlloyC4 >316L
KE6	10K 50,	RF,	AlloyC22 >316L
KL2	10K 80,	RF,	316L
KP2	10K 100,	RF,	316L

de - Verwendung
Grenzstanddetektion in Flüssigkeiten

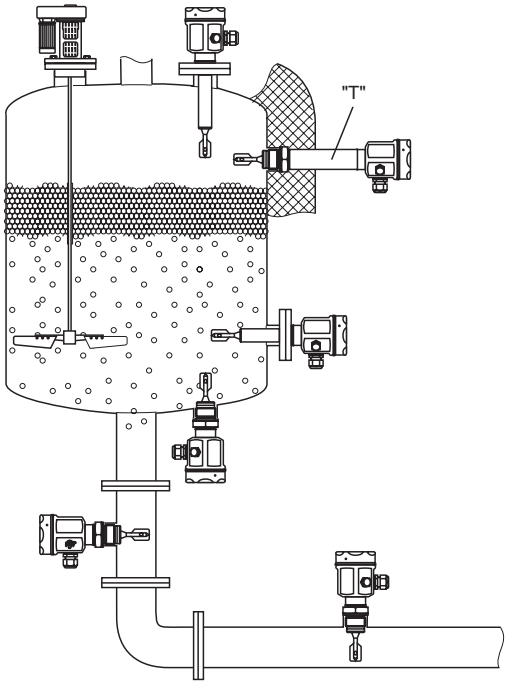
en - Application
Level limit detection in liquids

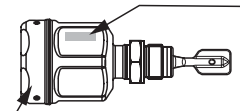
fr - Utilisation
Détection de niveau dans les liquides

es - Aplicación
Detección de nivel en líquidos

it - Applicazione
Controllo livello nei liquidi

nl - Toepassing
Niveaudetectie in vloeistoffen

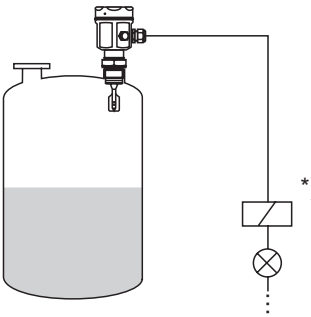




Order code:
FTL5# - # ### ## **#** ## #

Elektronikeinsätze
Electronic inserts
Electronique
Electrónica
Inserti elettronici
Elektronica-insert

FEL5**1**
FEL5**2**
FEL5**4**



*)

*) Externe Last
External load
Charge externe
Carga externa
Carico esterno
Externe belasting

de - Messeinrichtung
für direkten Anschluss

en - Measuring system
for direct connection

fr - Ensemble de détection de niveau
pour raccordement direct

es - Sistema de medida
para conexión directa

it - Sistema di misura
per connessione diretta

nl - Meetopstelling
voor directe aansluiting

de - Messeinrichtung
für Anschluss über Schaltgerät

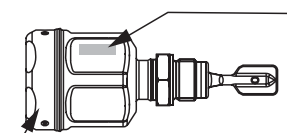
en - Measuring system
for connection via switching unit

fr - Ensemble de détection de niveau
pour raccordement via détecteur

es - Sistema de medida
para conexión vía interruptores

it - Sistema di misura
per connessione mediante unità di commutazione

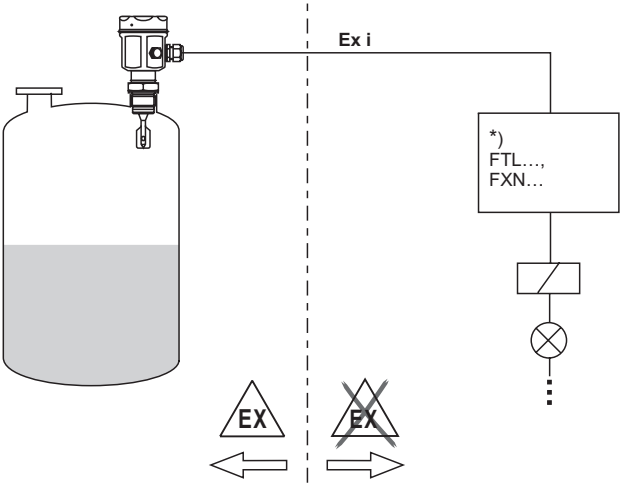
nl - Meetopstelling
voor aansluiting aan een schakelversterker



Order code:
FTL5# - # ### ## **#** ## #

Elektronikeinsätze
Electronic inserts
Electronique
Electrónica
Inserti elettronici
Elektronica-insert

FEL5**5**
FEL5**6**
FEL5**7**
FEL5**8**



*) Schaltgerät, SPS, Trennverstärker
Switching unit, PLC, isolating amplifier
Détecteur, API, convertisseur/ séparateur
Interruptor, PLC, amplificador aislado
Unità di commutazione, PLC, barriera di separazione
Schakelversterker, PLC, scheidingsversterker

de - Messeinrichtung
für Anschluss an PROFIBUS PA

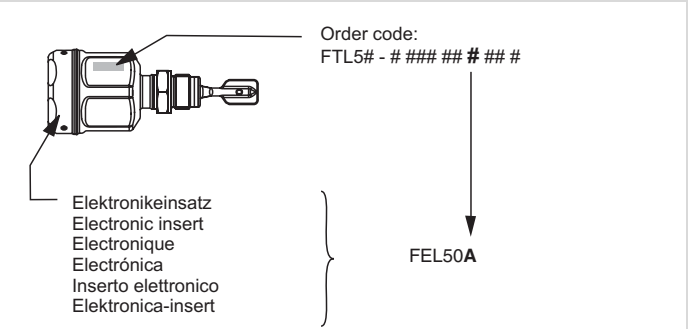
en - Measuring system
for connection to PROFIBUS PA

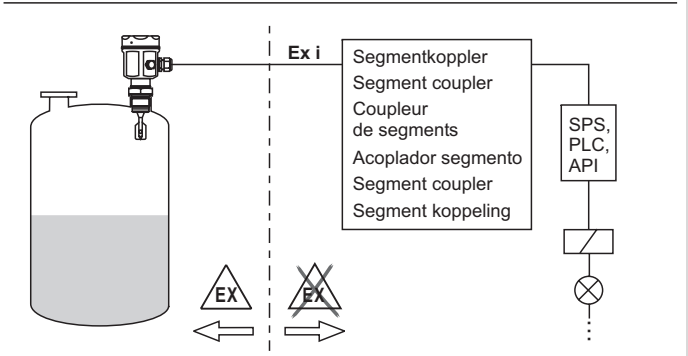
fr - Ensemble de détection de niveau
pour le raccordement à PROFIBUS PA

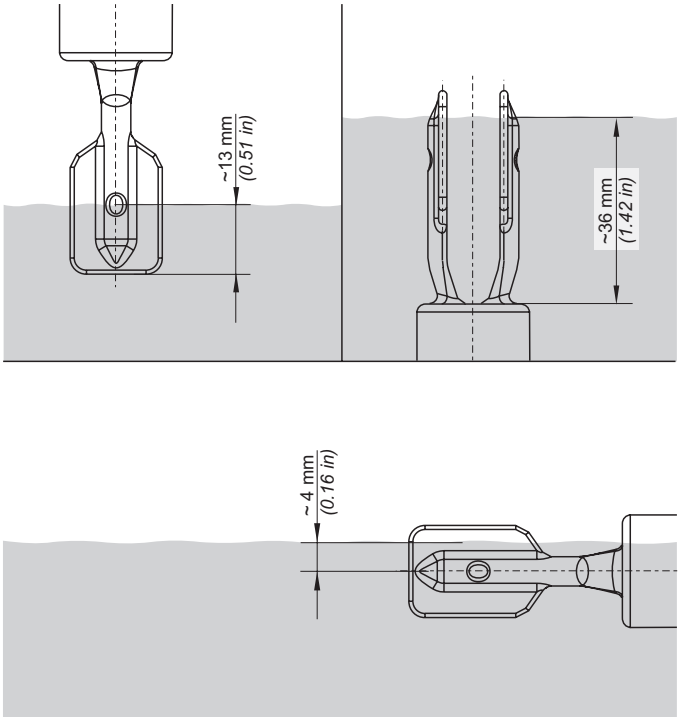
es - Sistema de medida
para conexión a PROFIBUS PA

it - Sistema di misura
per connessione a PROFIBUS PA

nl - Meetopstelling
voor aansluiting aan PROFIBUS PA







de - Einbau
Schaltpunkt in Abhängigkeit vom Einbau

en - Installation
Switchpoint depends on mounting position

fr - Montage
Point de commutation en fonction de l'implantation

es - Montaje
Punto de conmutación dependiendo de la posición de montaje

it - Montaggio
Punto di commutazione in funzione della posizione di montaggio

nl - Inbouw
Schakelpunt afhankelijk van inbouw

de – Einbaubeispiele
in Abhängigkeit von der Viskosität ν der Flüssigkeit

en – Mounting examples
as a function of liquid viscosity ν

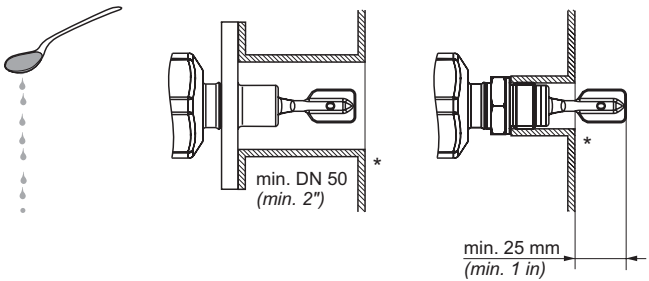
fr – Exemples d'implantation
dépendant de la viscosité ν
du liquide

es – Ejemplos de montaje
dependiendo de la viscosidad ν
del líquido

it – Esempi di montaggio
come funzione di viscosità ν
del liquido

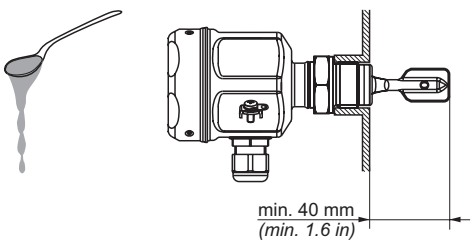
nl – Inbouwvoorbeelden
afhankelijk van de viscositeit ν
van de vloeistof

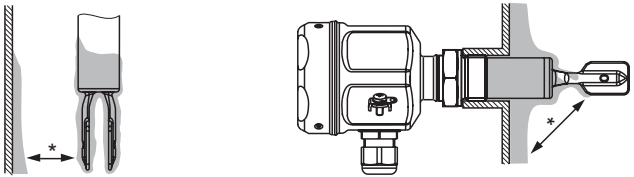
ν = 0…2000 mm²/s
(ν = 0…2000 cSt)



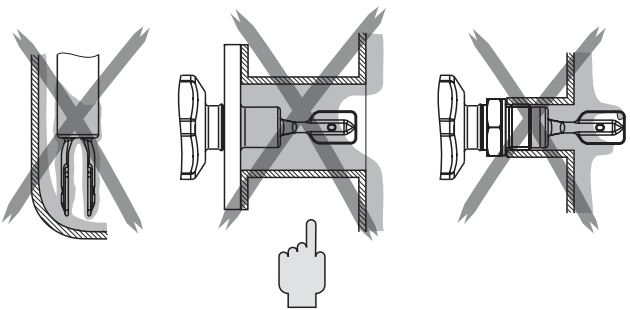
* entgraten / deburr / ébarber / libre / sbavare / ontbramen

ν = 0…10000 mm²/s
(ν = 0…10000 cSt)





* Abstand! / Distance! / Distance! / ¡Distancia! / Distanza! / Afstand!



de – Ansatzbildung berücksichtigen. Schwinggabel darf Ansatz nicht berühren.

en – Consider build-up. Fork may not contact the build-up.

fr – Tenir compte du colmatage. Fourche ne doit pas entrer en contact avec le dépôt.

es – Tener en cuenta las adherencias. Las horquillas no deben estar en contacto con las adherencias.

it – Tenere conto dei depositi. La forcella non deve entrare in contatto con i depositi.

nl – Rekening houden met aangroei. Trilvork mag de aangroei niet aanraken.

de – Bei dynamischer Belastung abstützen

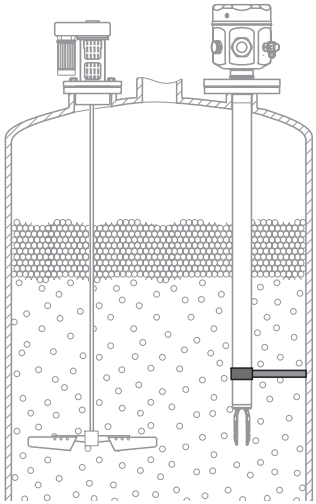
en – In cases of dynamic forces support

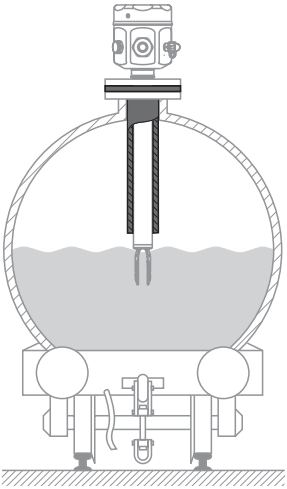
fr – En cas de contraintes dynamiques, étayer le tube

es – En caso de cargas dinámicas altas debe ser apoyado

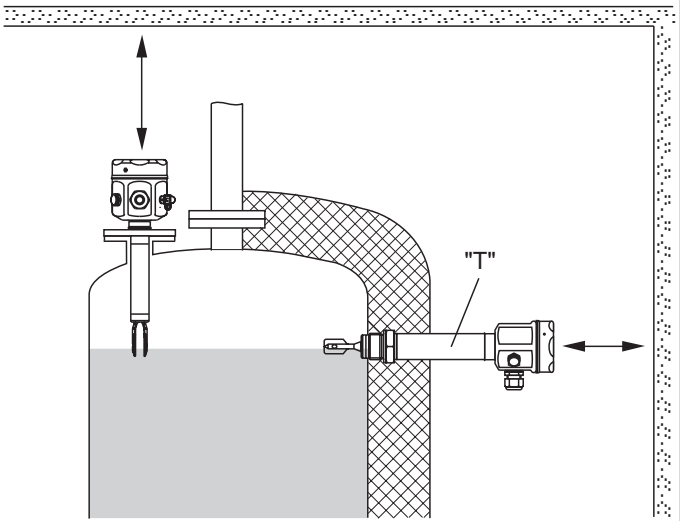
it – In caso di carichi dinamici, rinforzare con un supporto meccanico

nl – Bij mechanische belasting verstevigen





"T" = mit Temperaturdistanzstück für isolierten Tank
"T" = with temperature spacer for insulated tanks
"T" = avec élément de refroidissement pour réservoir isolé
"T" = con tramo disipador de temperatura para tanques aislados
"T" = con distanziale di temperatura per serbatoi isolati
"T" = met temperatuurreductiestuk voor geïsoleerde tanks



de – Freiraum vorsehen
en – Allow clearance
fr – Prévoir un espace libre
es – Prever espacio
it – Lasciare spazio per estrazione
nl – Ruimte vrijhouden

de – Schwinggabel ausrichten:
Markierung oben oder unten

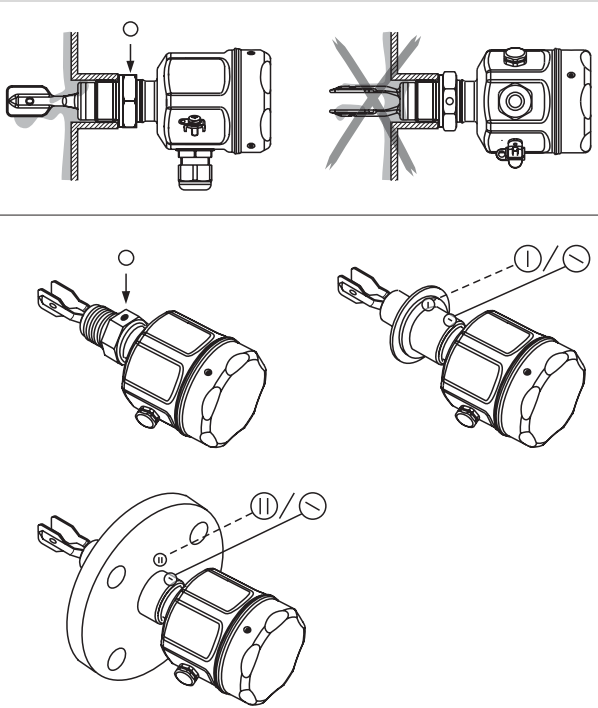
en – Orientation of fork tines:
Marking above or below

fr – Orientation des lames vibrantes:
Repères en haut ou en bas

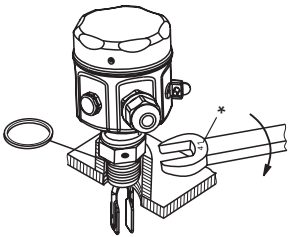
es – Orientación de la horquilla:
Marca arriba o abajo

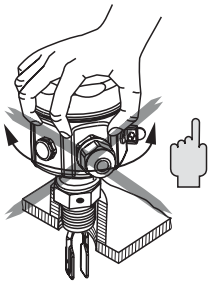
it – Allineamento della forcella:
Marcatura in alto o in basso

nl – Vork uitrichten:
Markering boven of onder

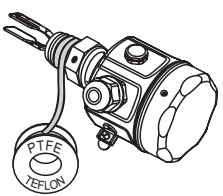


G ¾, 32 mm (1¼")*
G 1, 41 mm (1⅝")*

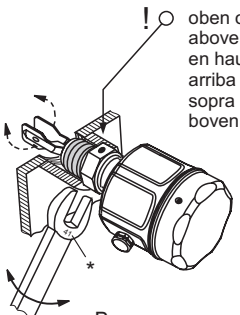




NPT ¾, R ¾, G ¾, 32 mm (1¼")*
NPT 1, R 1, G 1, 41 mm (1⅝")*



A



B

de – Liquiphant einschrauben.
Nicht am Gehäuse drehen.

en – Screw Liquiphant into process connection.
Don't use housing to turn.

fr – Visser le Liquiphant.
Ne pas se servir du boîtier.

es – Roscar el Liquiphant a la conexión a proceso.
No girar el cabezal.

it – Avvitare il Liquiphant all'attacco di processo.
Allo scopo **non** utilizzare la custodia.

nl – Schroef de Liquiphant in de procesaansluiting.
Draai hierbij **niet** aan de behuizing.

de – Ausrichten in Rohrleitungen:
Markierung in Fließrichtung

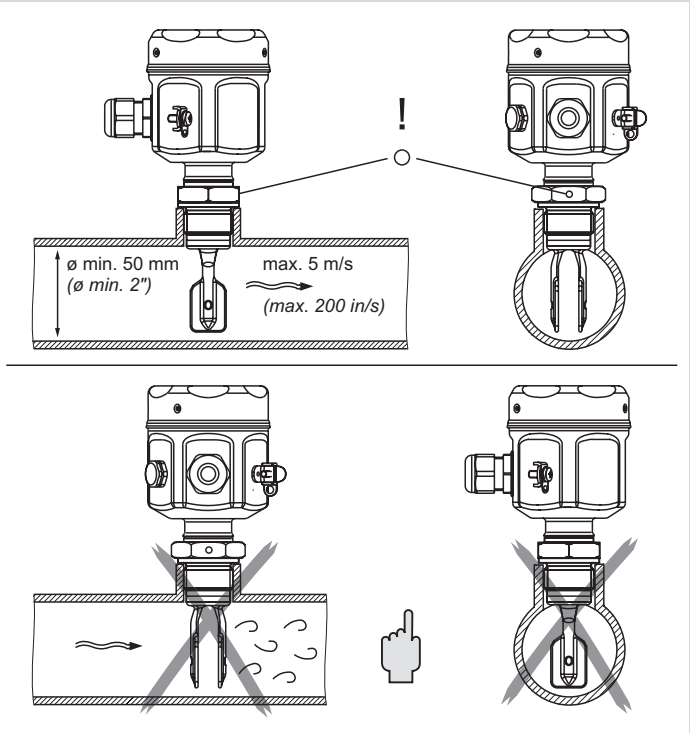
en – Orientation in pipes:
Marking in direction of flow

fr – Orientation dans une conduite:
Repère dans le sens de l'écoulement

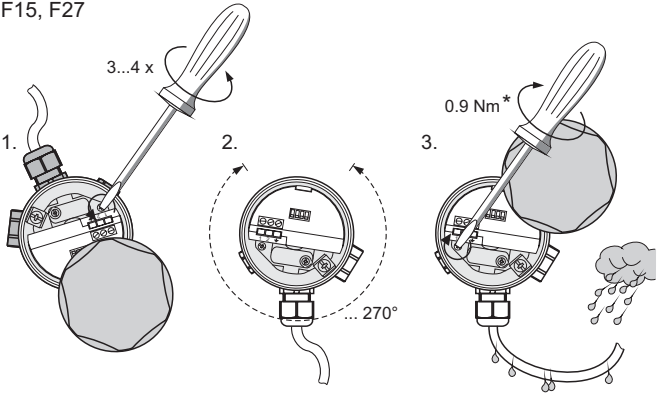
es – Montaje y orientación dentro de tuberías:
Marca en dirección del caudal

it – Allineamento per montaggio in tubazioni:
Marcatura nella direzione del flusso

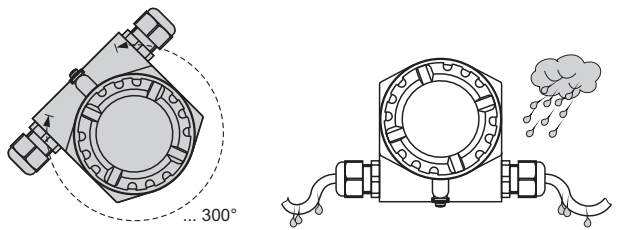
nl – Opstelling in leidingen:
Markering in de stroomrichting



F15, F27



F16, F13, F17



de – Kabeleinführung ausrichten

en – Cable gland orientation

fr – Positionnement de l'entrée de câble

es – Ajuste del prensaestopa

it – Posizionamento del passacavo

nl – Kabelinvoer uitrichten

* Anzugsdrehmoment /
Torque /
Couple de serrage /
Esfuerzo de torsión /
Coppia di torsione /
Aandraaimoment

de - Einstellungen
Minimum-/Maximum-Sicherheitsschaltung

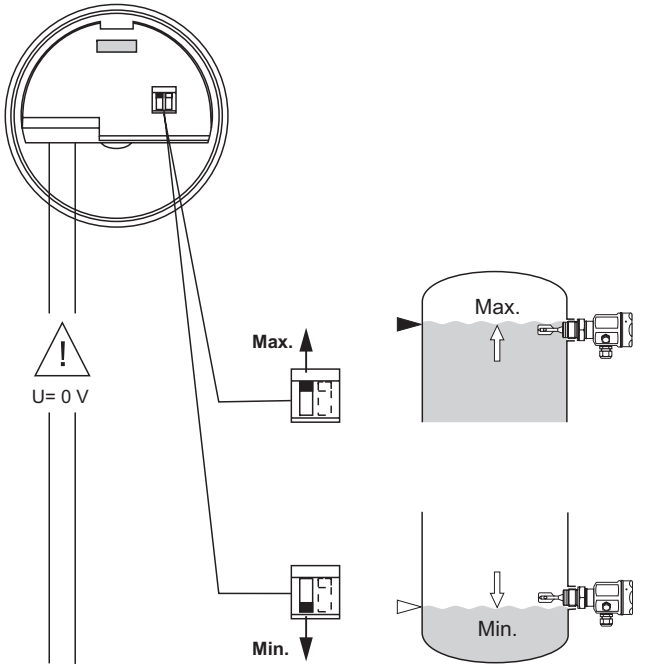
en - Setting-up
Minimum/maximum fail-safe mode

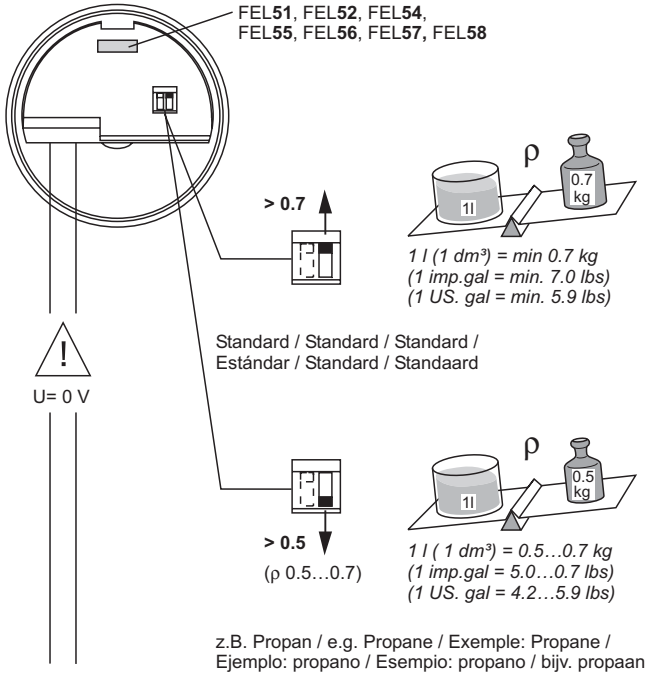
fr - Réglage
Sécurité minimum/maximum

es - Ajuste
Conmutador de seguridad mín./máx.

it - Messa in servizio
Selezione della modalità di sicurezza min./max.

nl - Instellingen
Minimum/maximum veiligheidsschakeling





de – Dichte der Flüssigkeit.
Dichte ρ gemessen in g/cm³ oder in kg/l.

en – Liquid density.
Density ρ measured in g/cm³ or in kg/l.

fr – Densité du liquide.
Unité de mesure de la densité ρ : g/cm³ ou kg/l.

es – Densidad de líquidos.
Densidad ρ medida en g/cm³ o en kg/l.

it – Densità del liquido.
Densità ρ misurata in g/cm³ o in kg/l.

nl – Dichtheid van de vloeistof.
Dichtheid ρ gemeten in g/cm³ of in kg/l.

de – Selbsttest FEL57
(Funktion siehe Seite 46, 47 und Schaltgerät)

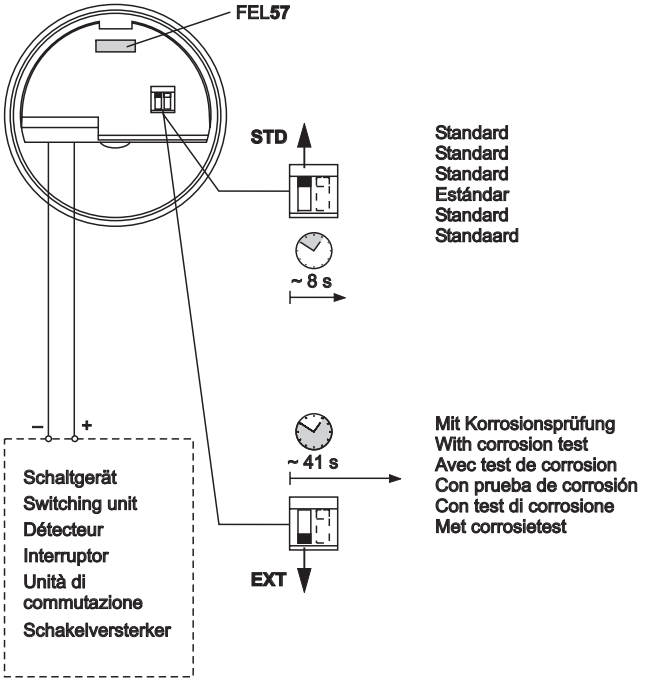
en – Selftest FEL57
(see page 46, 47 and switching unit for sequence)

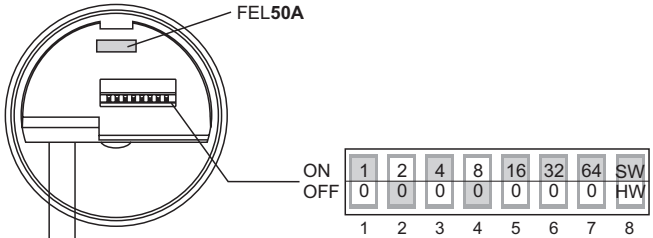
fr – Auto-test FEL57
(voir pages 46, 47 et détecteur)

es – Prueba automática FEL57
(ver pág. 46, 47 e interruptor para secuencia)

it – Prova automatica FEL57
(vds. pag. 46, 47 e unità di commutazione)

nl – Functietest FEL57
(zie voor functie pag 46, 47 en schakelversterker)





Beispiel / Example / Exemple / Ejemplo / Esempio / Bijv. :

2 + 8 = 10 = Adresse
Address
Adresse
Dirección
Indirizzo
Adres

Segmentkoppler
Segment coupler
Coupleur de segments
Acoplador segmento
Segment coupler
Segment koppeling

z.B. SPS / e. g. PLC /
p. e. API / por ej. PLC /
p. e. PLC / bijv. PLC /

de – Geräteadresse einstellen
(Einstellung der Parameter siehe BA141F)

en – Setting Device Address
(Setting the parameters, see BA141F)

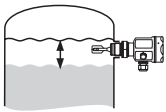
fr – Réglage de l'adresse d'appareil
(Réglage des paramètres voir BA141F)

es – Configuración de la dirección del equipo
(Ver configuración parámetros en BA141F)

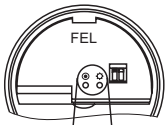
it – Impostare indirizzo del dispositivo
(Per impostazione parametri vds. BA141F)

nl – Instrumentadres instellen
(Parameter instelling zie BA141F)

de - Lichtsignale
en - Light signals
fr - Signaux lumineux
es - Señales luminosas
it - Segnali luminosi
nl - Lichtsignalen



Füllstand variieren
Vary level
Varier le niveau
Nivel variable
Variare livello
Niveau variëren



Leuchtdioden / LEDs / DEL / LEDs / LED / LED's

Betrieb / Stand-by / Fonctionnement /
Reposo / Attesa / stand-by

Schaltzustand / Switching status / Etat de commutation /
Estado conexión / Stato di commutazione / schakelstand

FEL57, FEL50A: Bedeckung / Covering / Recouvrement /
Cubierto / Copertura / bedekking

leuchtet / on / allumée / iluminado / on / aan

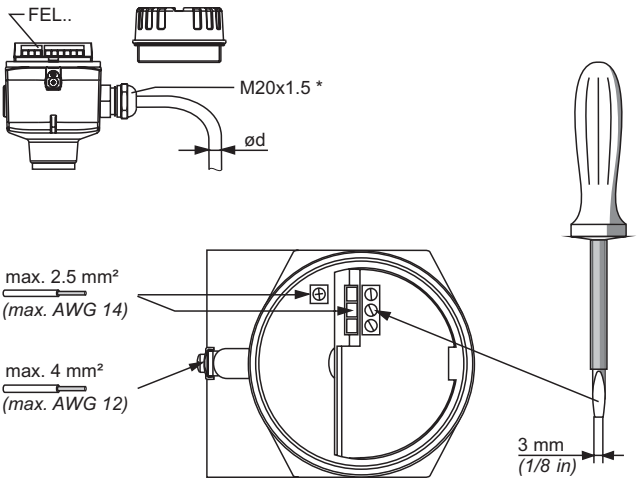
blinkt / flashes / clignote / parpadea / lampeggia / knippert

aus / off / éteinte / apagado / off / uit

Ausgangssignal / Output signal / Signal de sortie /
Señal de salida / Segnale uscita / uitgangssignaal

Störung / Fault / Défaut / Fallo / Guasto / storing

Nationale Normen und Vorschriften beachten!
Note national regulations!
Respecter les lois et règles locales en vigueur!
Considere reglamentaciones nacionales
Osservare le norme nazionali!
Nationale voorschriften in acht nemen!



de - Anschluss
en - Connections
fr - Raccordement
es - Conexiones
it - Collegamenti elettrici
nl - Aansluiting

***Cable entry**
Nickel-plated brass:
Ød = 7...10,5 mm (0,28...0,41 in)
Plastic:
Ød = 5...10 mm (0,2...0,38 in)
Stainless steel:
Ød = 7...12 mm (0,28...0,47 in)

de – Anschluss FEL51
Zweileiter-
Wechselstromanschluss

en – Connections FEL51
Two-wire AC connection

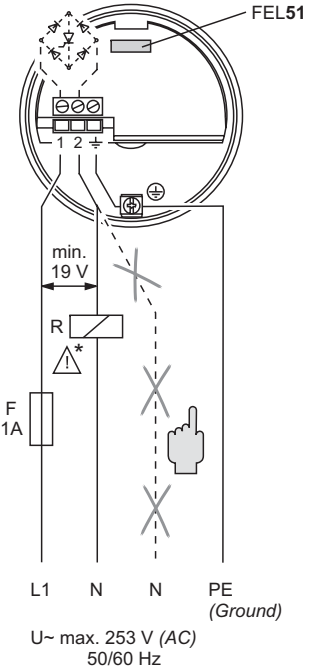
fr – Raccordement FEL51
Raccordement 2 fils
courant alternatif

es – Conexiones FEL51
Conexión a corriente alterna
a dos hilos

it – Collegamenti elettrici FEL51
Collegamento bifilare
con corrente alternata

nl – Aansluiting FEL51
2- draads
wisselspanningsaansluiting

Zerstörung
Destruction
Destruction
Destrucción
Distruzione
Storing



* Externe Last R **muss** angeschlossen werden

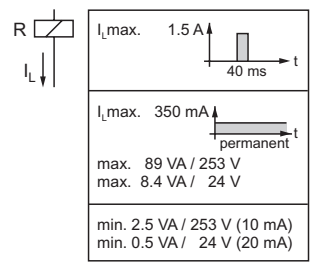
External load R **must** be connected

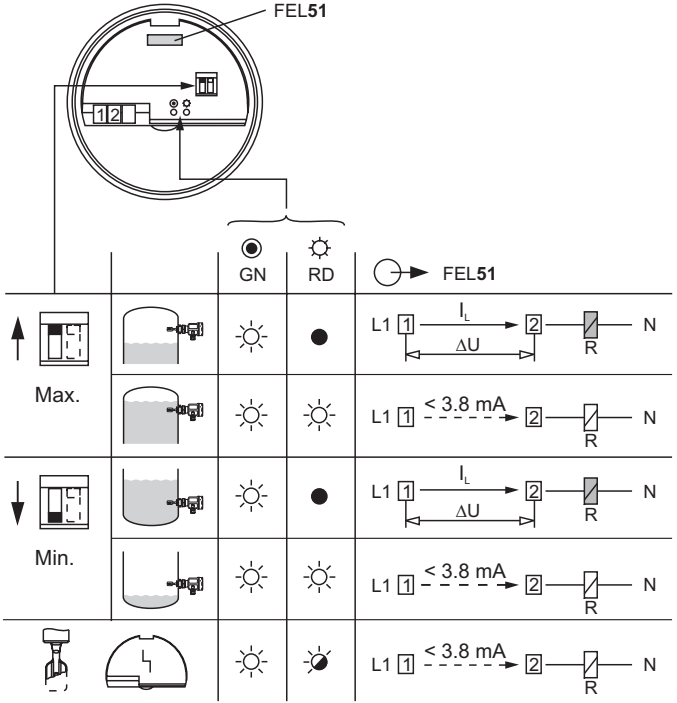
Charge externe R **doit** être raccordée

La carga externa R **debe** estar conectada

Il carico esterno R **deve** essere connesso

Externe belasting R **moet** aangesloten worden





de – Funktion FEL51
en – Function FEL51
fr – Fonction FEL51
es – Funcionamiento FEL51
it – Funzione FEL51
nl – Functie FEL51

ΔU_{FEL51} max. 12 V

de – Anschluss FEL52
Gleichstromanschluss (PNP)

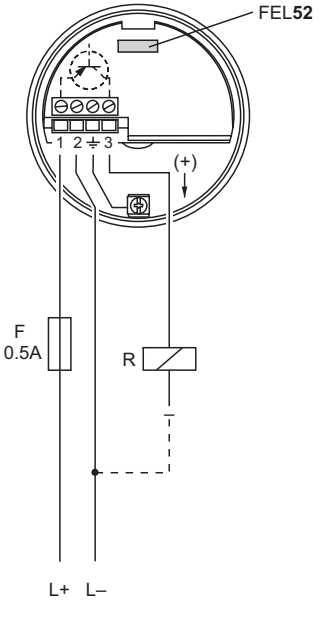
en – Connections FEL52
DC connection (PNP)

fr – Raccordement FEL52
Courant continu (PNP)

es – Conexiones FEL52
Alimentación CC (PNP)

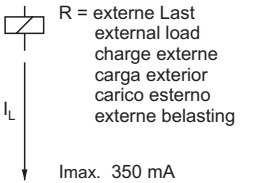
it – Collegamenti elettrici FEL52
Collegamento CC (PNP)

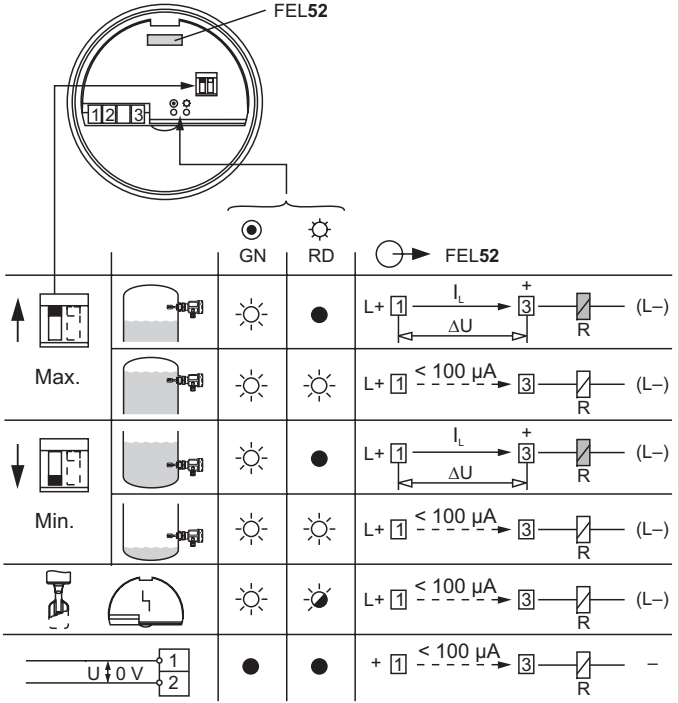
nl – Aansluiting FEL52
Gelijkspanningsaansluiting (PNP)



auch für DI-Module
also for DI modules
également pour des modules DI
también para módulos DI
anche per DI modules
aan de DI-module

EN 61131-2





de – Funktion FEL52

en – Function FEL52

fr – Fonction FEL52

es – Funcionamiento FEL52

it – Funzione FEL52

nl – Functie FEL52

ΔU_{FEL52} max. 3 V

de – Anschluss FEL54
Allstromanschluss
Relaisausgang

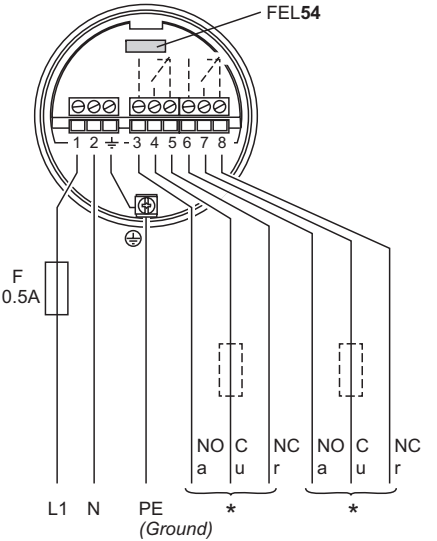
en – Connections FEL54
Universal connection
Relay output

fr – Raccordement FEL54
Tous courants
Sorties relais

es – Conexiones FEL54
Conexión universal
Salida por relé

it – Collegamenti elettrici FEL54
Collegamento corrente universale
Uscita relè

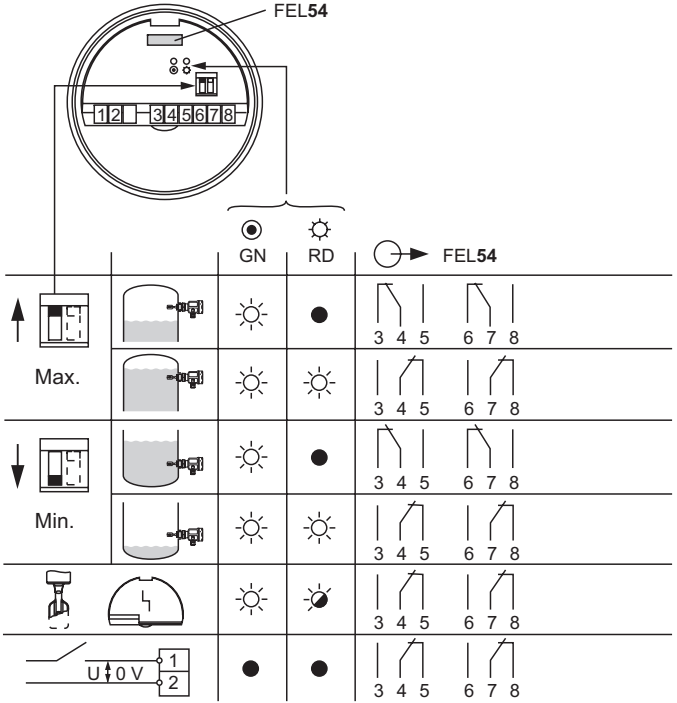
nl – Aansluiting FEL54
Universele spanningsaansluiting
Relaisuitgang



U~ 19…253 V *(AC)*

L+ L–
U⎓ 19… 55 V *(DC)*

* U~ max. 253 V, I~ max. 6 A
P~ max. 1500 VA, cos φ = 1
P~ max. 750 VA, cos φ > 0.7
I⎓ max. 6 A, U⎓ < 30 V
I⎓ max. 0.2 A, U⎓ < 125 V



de – Funktion FEL54
en – Function FEL54
fr – Fonction FEL54
es – Funcionamiento FEL54
it – Funzione FEL54
nl – Functie FEL54

de – Anschluss FEL55
Ausgang
8/16 mA

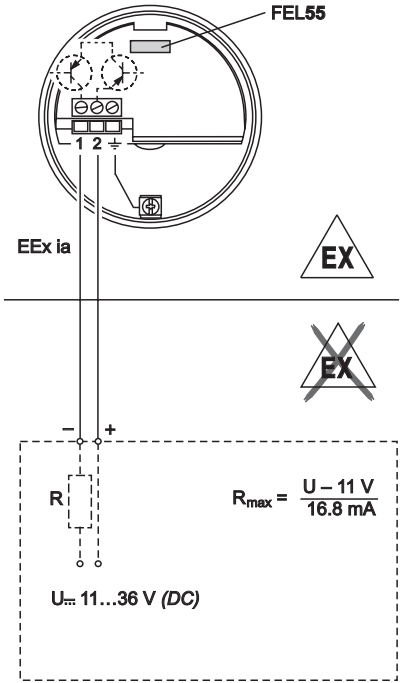
en – Connections FEL55
Output
8/16 mA

fr – Raccordement FEL55
Sortie
8/16 mA

es – Conexiones FEL55
Salida
8/16 mA

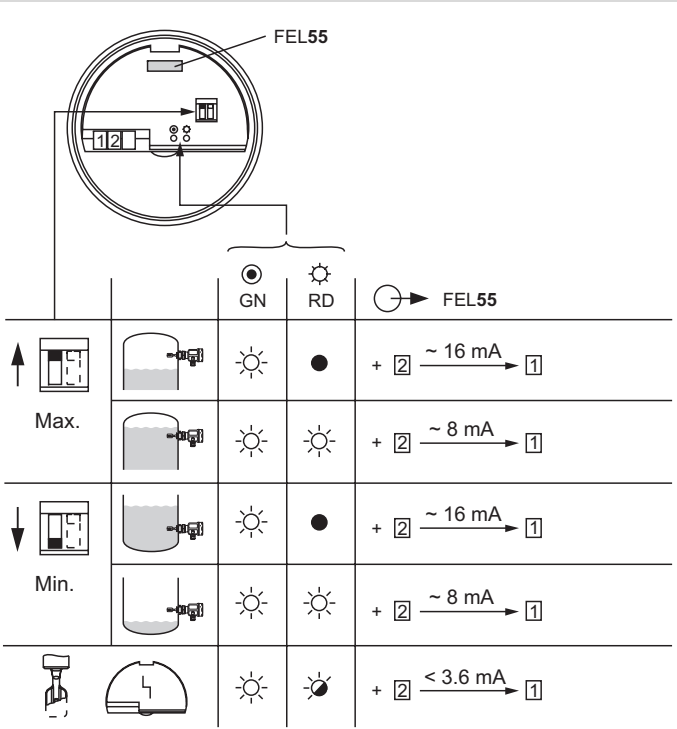
it – Collegamenti elettrici FEL55
Uscita
8/16 mA

nl – Aansluiting FEL55
Uitgang
8/16 mA



z.B. SPS, AI-Module
e. g. PLC, AI modules
p. e. API, modules AI
por ej. PLC, módulos AI
p. e. PLC, AI modules
bijv. PLC, AI-module

4...20 mA
EN 61131-2



de – Funktion FEL55
en – Function FEL55
fr – Fonction FEL55
es – Funcionamiento FEL55
it – Funzione FEL55
nl – Functie FEL55

de – Anschluss FEL56
NAMUR- Ausgang L-H
< 1,0 mA / > 2,2 mA

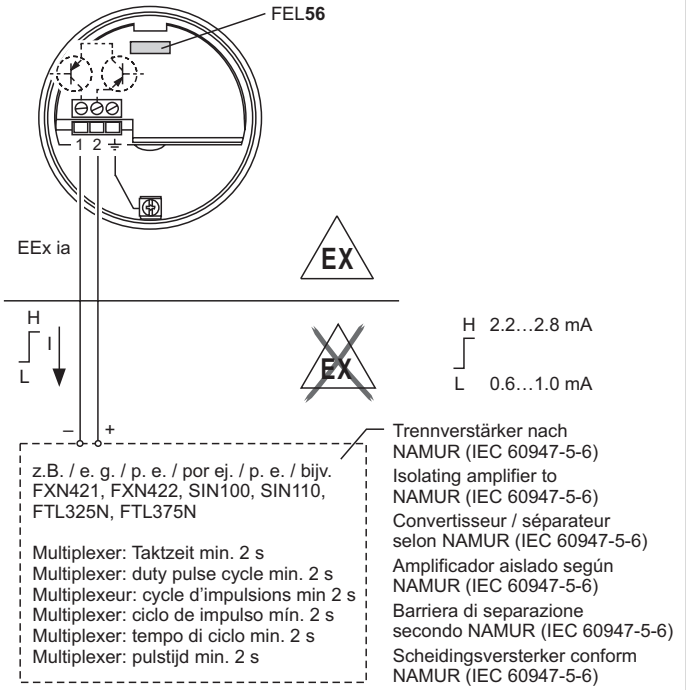
en – Connections FEL56
NAMUR output L-H
< 1,0 mA / > 2,2 mA

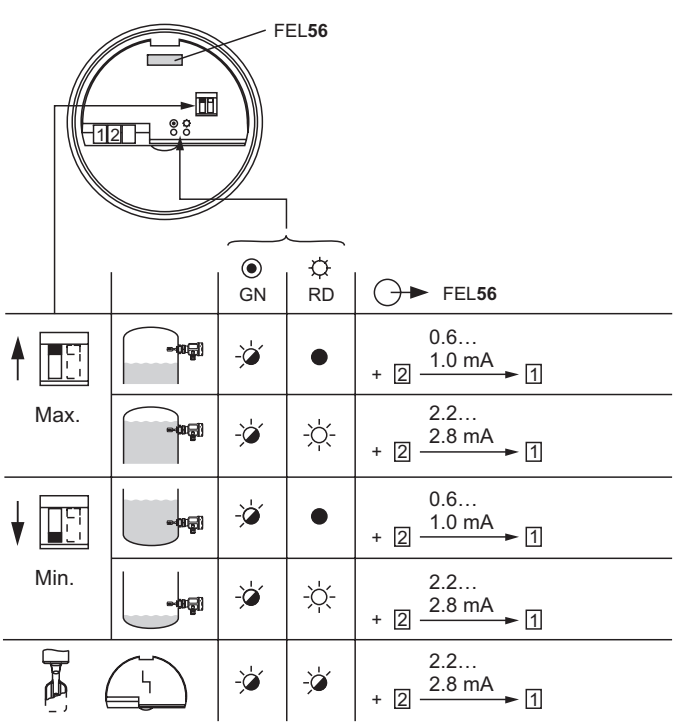
fr – Raccordement FEL56
Sortie NAMUR L-H
< 1,0 mA / > 2,2 mA

es – Conexiones FEL56
Salida NAMUR L-H
< 1,0 mA / > 2,2 mA

it – Collegamenti elettrici FEL56
NAMUR uscita L-H
< 1,0 mA / > 2,2 mA

nl – Aansluiting FEL56
NAMUR uitgang L-H
< 1,0 mA / > 2,2 mA


FEL56
1 2
EEx ia
EX
EX
H
I
L
H 2.2…2.8 mA
L 0.6…1.0 mA
–
+
z.B. / e. g. / p. e. / por ej. / p. e. / bijv.
FXN421, FXN422, SIN100, SIN110,
FTL325N, FTL375N
Multiplexer: Taktzeit min. 2 s
Multiplexer: duty pulse cycle min. 2 s
Multiplexeur: cycle d'impulsions min 2 s
Multiplexer: ciclo de impulso mín. 2 s
Multiplexer: tempo di ciclo min. 2 s
Multiplexer: pulstijd min. 2 s
Trennverstärker nach NAMUR (IEC 60947-5-6)
Isolating amplifier to NAMUR (IEC 60947-5-6)
Convertisseur / séparateur selon NAMUR (IEC 60947-5-6)
Amplificador aislado según NAMUR (IEC 60947-5-6)
Barriera di separazione secondo NAMUR (IEC 60947-5-6)
Scheidingsversterker conform NAMUR (IEC 60947-5-6)



de – Funktion FEL56
en – Function FEL56
fr – Fonction FEL56
es – Funcionamiento FEL56
it – Funzione FEL56
nl – Functie FEL56

de – Anschluss FEL57
Ausgang PFM
150 Hz / 50 Hz

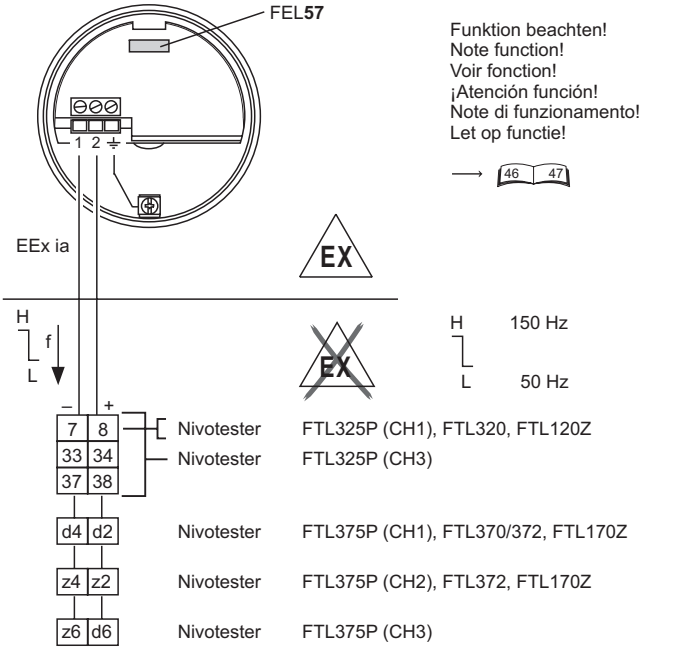
en – ConnectionsFEL 57
PFM output
150 Hz / 50 Hz

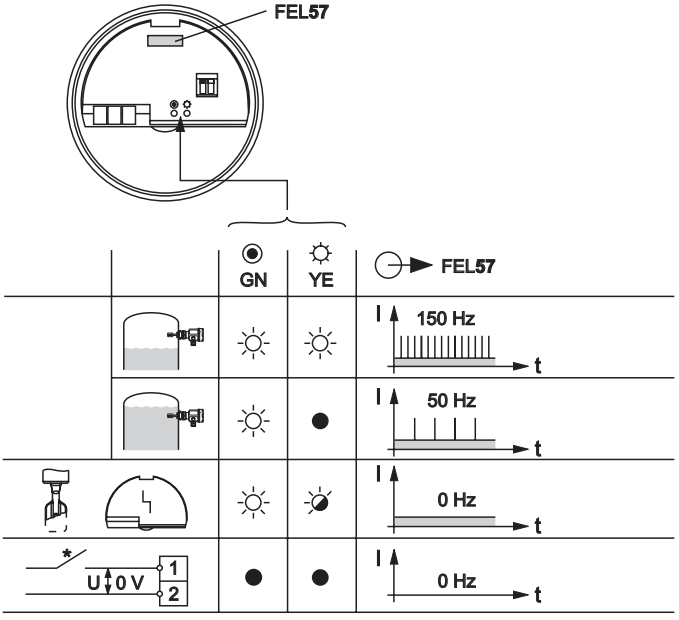
fr – Raccordement FEL57
Sortie PFM
150 Hz / 50 Hz

es – Conexiones FEL57
Salida PFM
150 Hz / 50 Hz

it – Collegamenti elettrici FEL57
PFM uscita
150 Hz / 50 Hz

nl – Aansluiting FEL57
PFM uitgang
150 Hz / 50 Hz





de – Funktion FEL57
en – Function FEL57
fr – Fonction FEL57
es – Funcionamiento FEL57
it – Funzione FEL57
nl – Functie FEL57

de – Einschaltverhalten
Selbsttest (STD)

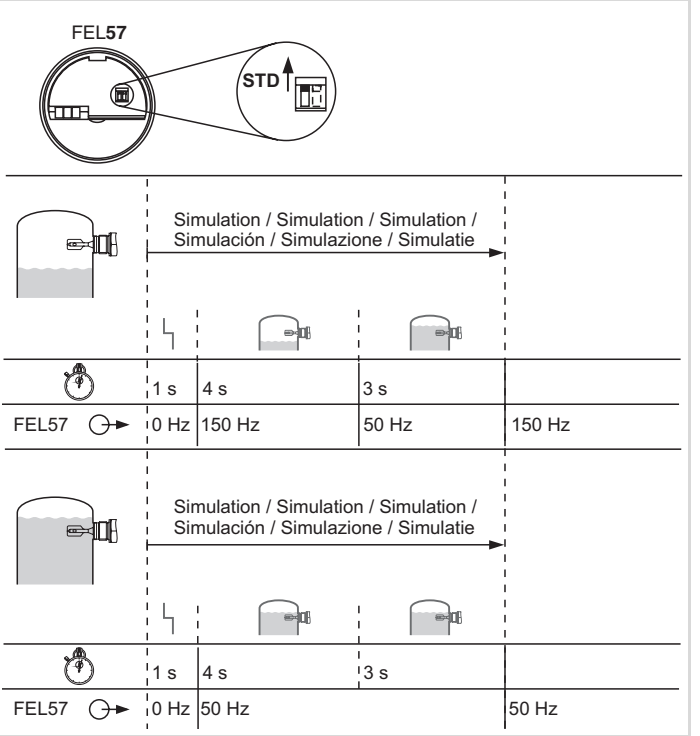
en – Switch-on behaviour
Selftest (STD)

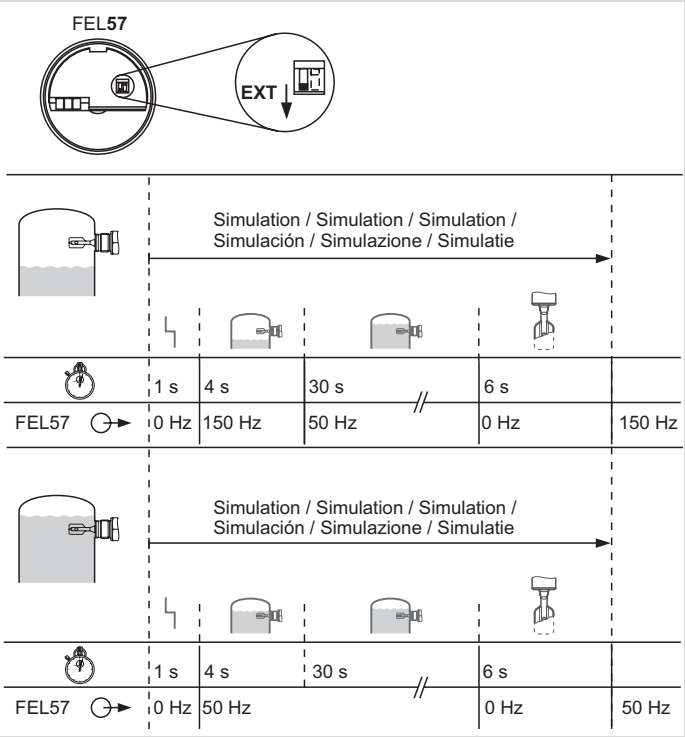
fr – Comportement à la mise sous tension
Auto-test (STD)

es – Comportamiento del cambio de e stado
Prueba automática (STD)

it – Comportamento in fase di accensione
Prova automatica (STD)

nl – Inschakelgedrag
Functietest (STD)





de – Einschaltverhalten
Selbsttest (EXT)

en – Switch-on behaviour
Selftest (EXT)

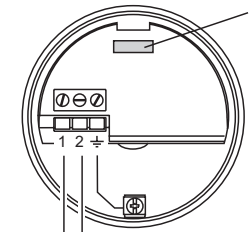
fr – Comportement à la mise sous tension
Auto-test (EXT)

es – Comportamiento del cambio de e stado
Prueba automática (EXT)

it – Comportamento in fase di accensione
Prova automatica (EXT)

nl – Inschakelgedrag
Functietest (EXT)

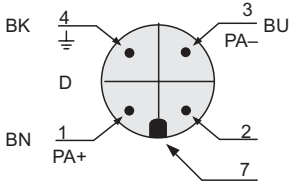
de – Anschluss FEL50A
en – Connections FEL50A
fr – Raccordement FEL50A
es – Conexiones FEL50A
it – Collegamenti elettrici FEL50A
nl – Aansluiting FEL50A



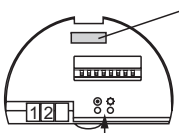
Segmentkoppler
Segment coupler
Coupleur de segments
Acoplador segmento
Segment coupler
Segment koppeling

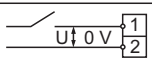
z.B. SPS / e. g. PLC
p. e. API / por ej. PLC
p. e. PLC / bijv. PLC

M12-Stecker / M12 Plug /
Connecteur M12 / M12 Conector /
Connettore M12 / M12 Connector



Gerätestecker am Gehäuse (male)
Device plug on housing (male)
Connecteur d'appareil sur le boîtier (mâle)
Conector del equipo en cabezal (macho)
Connettore del dispositivo (maschio)
Instrumentsteker op behuizing (male)



		FEL**50A** PA-Bussignal / PA Bus Signal / Signal bus PA / Señal Bus PA / Segnale bus PA / PA bussignaal	
		GN	YE
nicht invertiert not inverted non inversé no invertido non invertito niet geïnverteerd		☼	●
		☼	☼
invertiert inverted inversé invertido invertito geïnverteerd		☼	☼
		☼	●
SPS Commuwin II		☼	–
		–	☼
		●	●

Kommunikation/ Communication/ Communication / Comunicación / Comunicazione / Communicatie

Status siehe BA141F
Status, see BA141F
Etat, voir BA141F
Estado, ver BA141F
Stato, vedere BA141F
Status, zie BA141F

../..

de – Funktion FEL50A
en – Function FEL50A
fr – Fonction FEL50A
es – Funcionamiento FEL50A
it – Funzione FEL50A
nl – Functie FEL50A

de - Anschluss FEL58
NAMUR- Ausgang H-L
> 2,2 mA / < 1,0 mA

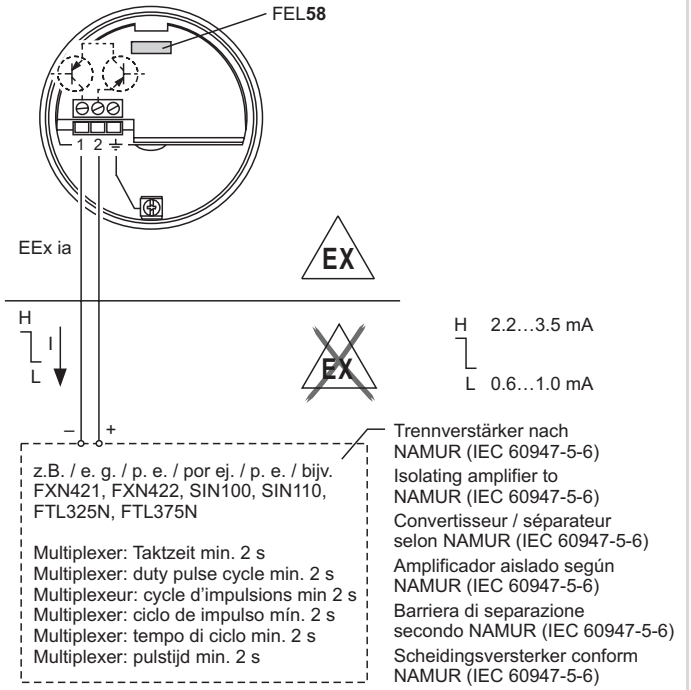
en - Connections FEL58
NAMUR output H-L
> 2,2 mA / < 1,0 mA

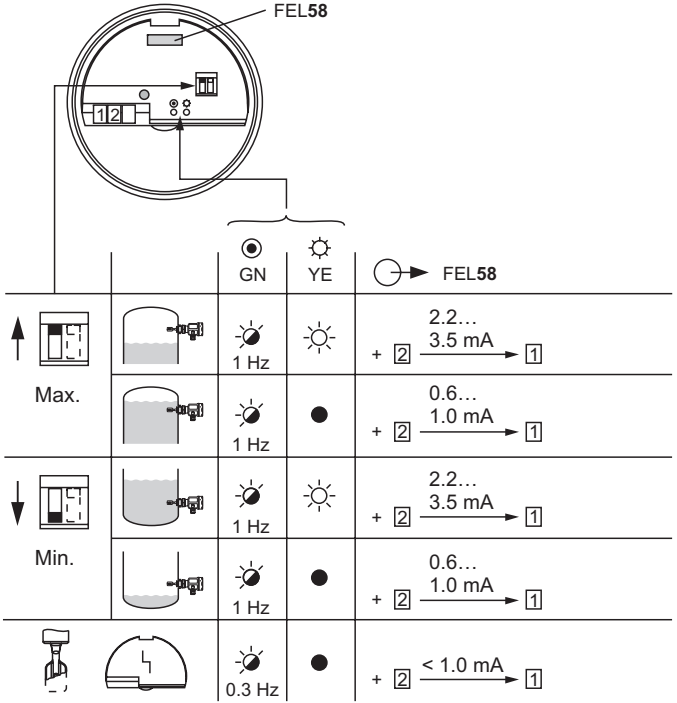
fr - Raccordement FEL58
Sortie NAMUR H-L
> 2,2 mA / < 1,0 mA

es - Conexiones FEL58
Salida NAMUR H-L
> 2,2 mA / < 1,0 mA

it - Collegamenti elettrici FEL58
NAMUR uscita H-L
> 2,2 mA / < 1,0 mA

nl - Aansluiting FEL58
NAMUR uitgang H-L
> 2,2 mA / < 1,0 mA


FEL58
1 2
EEx ia
EX
EX
H
I
L
H 2.2…3.5 mA
L 0.6…1.0 mA
– +
z.B. / e. g. / p. e. / por ej. / p. e. / bijv.
FXN421, FXN422, SIN100, SIN110,
FTL325N, FTL375N
Multiplexer: Taktzeit min. 2 s
Multiplexer: duty pulse cycle min. 2 s
Multiplexeur: cycle d'impulsions min 2 s
Multiplexer: ciclo de impulso mín. 2 s
Multiplexer: tempo di ciclo min. 2 s
Multiplexer: pulstijd min. 2 s
Trennverstärker nach NAMUR (IEC 60947-5-6)
Isolating amplifier to NAMUR (IEC 60947-5-6)
Convertisseur / séparateur selon NAMUR (IEC 60947-5-6)
Amplificador aislado según NAMUR (IEC 60947-5-6)
Barriera di separazione secondo NAMUR (IEC 60947-5-6)
Scheidingsversterker conform NAMUR (IEC 60947-5-6)



de – Funktion FEL58
en – Function FEL58
fr – Fonction FEL58
es – Funcionamiento FEL58
it – Funzione FEL58
nl – Functie FEL58

de – Funktion Prüftaste FEL58
Sicherheitsschaltung MAX

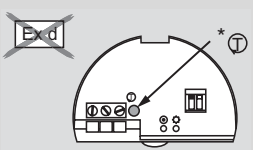
en – Function test button FEL58
Fail-safe mode MAX

fr – Fonction touche test FEL58
Sécurité MAX

es – Funcionamiento
botón de prueba FEL58
Conmutador de seguridad MAX

it – Funzione pulsante test FEL58
Selezione della modalità di
sicurezza MAX

nl – Functie testknop FEL58
Veiligheidsschakeling MAX



1. Normaler Betrieb / Normal operation / Fonctionnement normal / Funcionamiento normal / Funzionamento normale / Normaal bedrijf	GN YE 1 Hz + 2 → 1 2.2… 3.5 mA	GN YE 1 Hz + 2 → 1 0.6… 1.0 mA
2. Prüftaste drücken / Press test button / Appuyer sur la touche test / Pulse el botón de prueba / Premere il pulsante test / Testknop indrukken >3 s	GN YE + 2 → 1 0 mA	GN YE + 2 → 1 0 mA
3. Prüftaste loslassen, nach ~2 s normaler Betrieb / Release the test button, after ~2 s normal operation / Relâcher la touche test, après ~2 s fonctionnement normal / Deje de presionar el botón de prueba, después de ~2 s funcionamiento normal / Rilasciare il pulsante test, dopo ~2 s funzionamento normale / De testknop loslaten, na ~2 s normaal bedrijf	GN YE 1 Hz + 2 → 1 2.2… 3.5 mA	GN YE 1 Hz + 2 → 1 0.6… 1.0 mA

MIN + T		
1. Normaler Betrieb / **Normal operation /** **Fonctionnement normal /** **Funcionamiento normal /** **Funzionamento normale /** **Normaal bedrijf**	GN YE 1 Hz + 2.2… 3.5 mA 2 → 1	GN YE 1 Hz + 0.6… 1.0 mA 2 → 1
2. Prüftaste drücken / **Press test button /** **Appuyer sur la touche test /** **Pulse el botón de prueba /** **Premere il pulsante test /** **Testknop indrukken** >3 s	GN YE + 0 mA 2 → 1	GN YE + 0 mA 2 → 1
3. Prüftaste loslassen, **nach ~2 s normaler Betrieb /** **Release the test button,** **after ~2 s normal operation /** **Relâcher la touche test,** **après ~2 s fonctionnement normal /** **Deje de presionar el botón de prueba,** **después de ~2 s funcionamiento normal /** **Rilasciare il pulsante test,** **dopo ~2 s funzionamento normale /** **De testknop loslaten,** **na ~2 s normaal bedrijf**	GN YE 1 Hz + 2.2… 3.5 mA 2 → 1	GN YE 1 Hz + 0.6… 1.0 mA 2 → 1

de - Funktion Prüftaste FEL58
Sicherheitsschaltung MIN

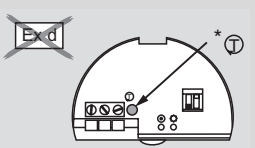
en - Function test button FEL58
Fail-safe mode MIN

fr - Fonction touche test FEL58
Sécurité MIN

es - Funcionamiento
botón de prueba FEL58
Conmutador de seguridad MIN

it - Funzione pulsante test FEL58
Selezione della modalità di
sicurezza MIN

nl - Functie testknop FEL58
Veiligheidsschakeling MIN



de - Wartung, Reinigung
Anbackungen entfernen

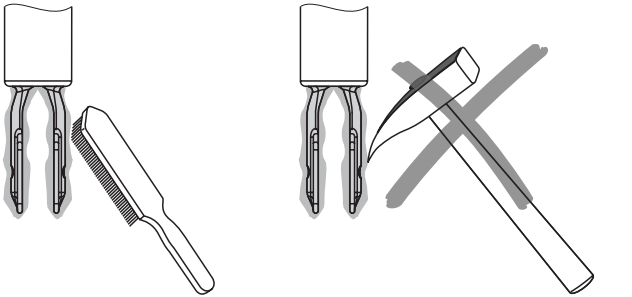
en - Maintenance, Cleaning
Removal of encrustation

fr - Entretien, Nettoyage
Enlever les incrustations

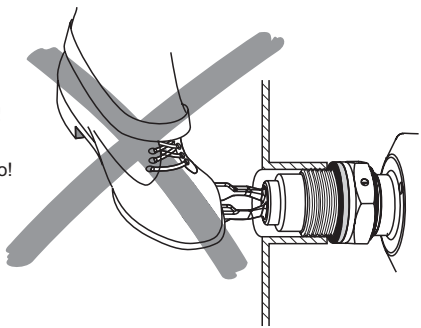
es - Mantenimiento, Limpieza
Eliminación de adherencias

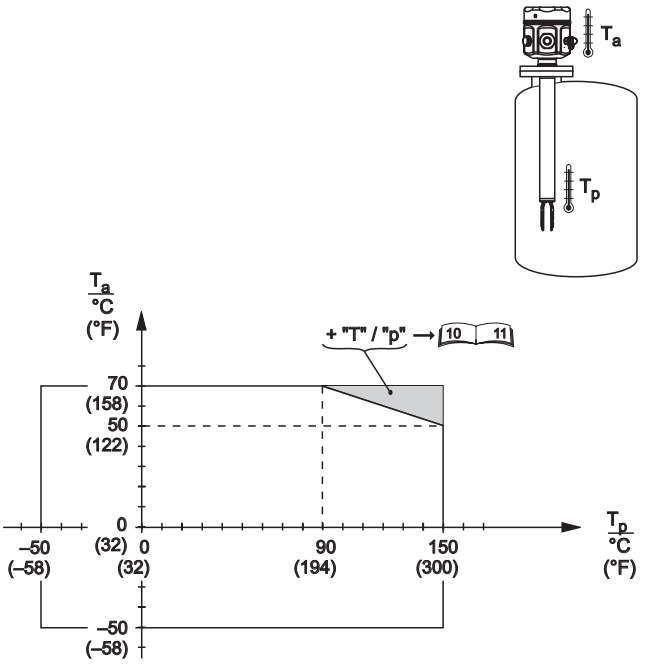
it - Manutenzione, Pulizia
Rimozione dei depositi

nl - Onderhoud, Reiniging
Aangroei verwijderen



Nicht besteigen!
Don't use as a step!
Ne pas marcher
sur les lames vibrantes!
No usar como peldaño!
Non usare come scalino!
Niet op staan!





de - Technische Daten
Umgebungstemperatur T_a
Prozesstemperatur T_p

en - Technical Data
Ambient temperature T_a
Process temperature T_p

fr - Caractéristiques techniques
Température ambiante T_a
Température de process T_p

es - Datos técnicos
Temperatura ambiente T_a
Temperatura del proceso T_p

it - Dati tecnici
Temperatura ambiente T_a
Temperatura di processo T_p

nl - Technische gegevens
Omgevingstemperatuur T_a
Procestemperatuur T_p

de – Prozessdruck p_e
Prozesstemperatur T_p

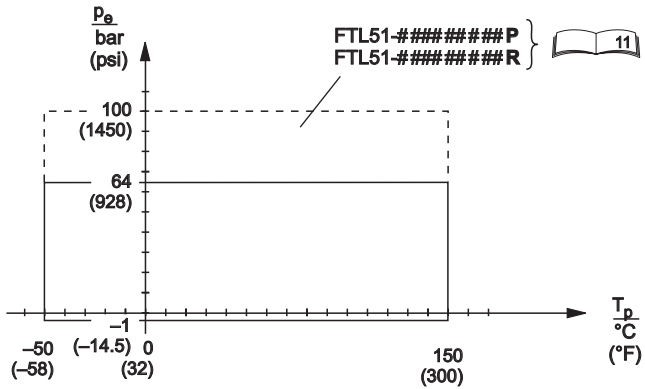
en – Process pressure p_e
Process temperature T_p

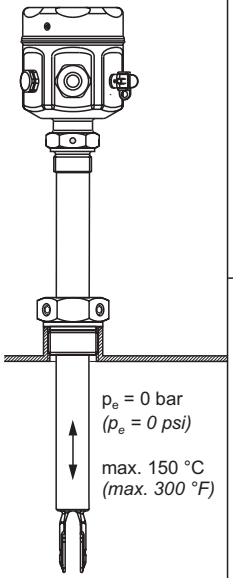
fr – Pression de process p_e
Température de process T_p

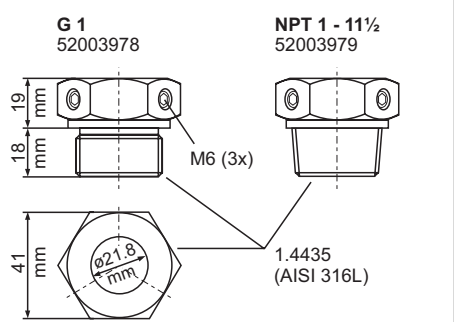
es – Presión del proceso p_e
Temperatura del proceso T_p

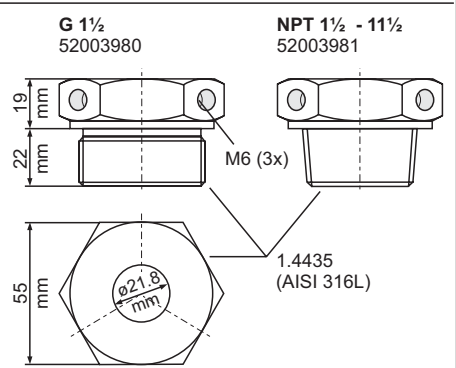
it – Pressione di processo p_e
Temperatura di processo T_p

nl – Procesdruk p_e
Procestemperatuur T_p









de - Zubehör
Schiebemuffen für drucklosen Betrieb

en - Accessories
Sliding sleeves for unpressurised operation

fr - Accessoires
Manchons coulissants pour applications sans pression

es - Accesorios
Manguitos deslizantes para operación sin presión

it - Accessori
Manicotto scorrevole per impieghi privi di pressione

nl - Toebehoren
Schuifmof voor drukloze toepassing

siehe / see / voir / ver / vedi / zie :
KA151F (G 1, NPT 1)
KA152F (G 1½, NPT 1½)

100 mm = 3. 94 in

de – Hochdruck-Schiebemuffen

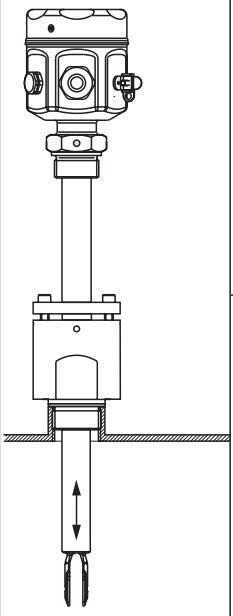
en – High pressure sliding sleeves

fr – Manchons coulissants haute pression

es – Manguitos deslizantes para alta presión

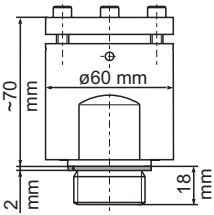
it – Manicotto scorrevole per impieghi ad alta pressione

nl – Schuifmof voor toepassing onder druk



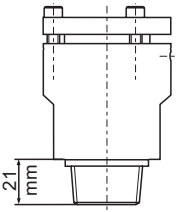
G 1
1.4435 (AISI 316L)
52003663

AlloyC4: 52003664
AlloyC22: 71118691



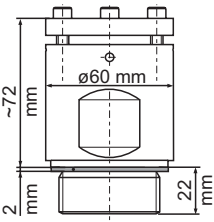
NPT 1 - 11½
1.4435 (AISI 316L)
52003667

AlloyC4: 52003668
AlloyC22: 71118694



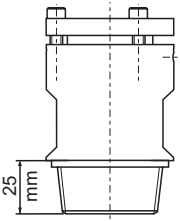
G 1½
1.4435 (AISI 316L)
52003665

AlloyC4: 52003666
AlloyC22: 71118693



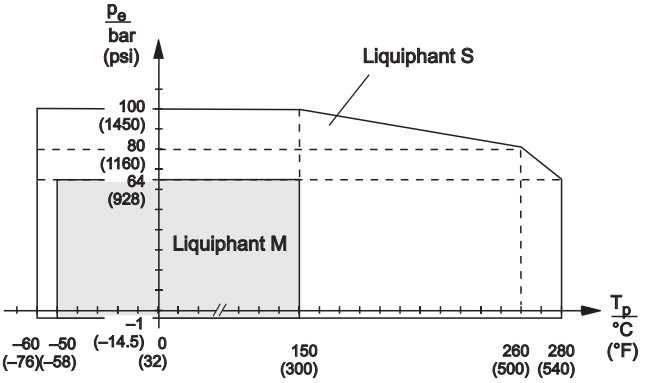
NPT 1½ - 11½
1.4435 (AISI 316L)
52003669

AlloyC4: 52003670
AlloyC22: 71118695



siehe / see / voir / ver / vedi / zie :
KA153F (G 1, NPT 1)
KA154F (G 1½, NPT 1½)

100 mm = 3. 94 in



de – Hochdruck-Schiebemuffen:
Prozessdruck p_e
Prozesstemperatur T_p

en – High pressure sliding sleeves:
Process pressure p_e
Process temperature T_p

fr – Manchons coulissants haute pression:
Pression de process p_e
Température de process T_p

es – Manguitos deslizantes para alta presión:
Presión del proceso p_e
Temperatura del proceso T_p

it – Manicotto scorrevole per impieghi ad alta pressione:
Pressione di processo p_e
Temperatura di processo T_p

nl – Schuifmof voor toepassing onder druk:
Procesdruk p_e
Procestemperatuur T_p

Fehlfunktion	Ursache	Maßnahme
Schaltet nicht	Versorgungsspannung fehlt	Versorgung prüfen
	Signalleitung defekt	Signalleitung prüfen
	Elektronikeinsatz defekt – FEL51 direkt an L1 und N angeschlossen	Austauschen – FEL51 immer über externe Last anschließen
	Dichte der Flüssigkeit zu gering	Am Elektronikeinsatz Dichte auf > 0,5 einstellen
	Schwinggabel verkrustet	Schwinggabel säubern
	Schwinggabel korrodiert (Anzeige am FEL: rot/gelb blinkt, FEL58: grün blinkt 0,3 Hz)	Schwinggabel komplett mit Prozessanschluss austauschen
	FEL51: Relais mit zu großem Innenwiderstand angeschlossen	Geeignetes Relais anschließen
	FEL51: Relais mit zu geringem Haltestrom angeschlossen	Widerstand parallel zum Relais anschließen
	FEL54: Kontakte verschweißt (nach einem Kurzschluss)	FEL54 austauschen; Sicherung in den Kontaktstromkreis
Schaltet falsch	Minimum-/Maximum- Sicherheitsschaltung vertauscht	Am Elektronikeinsatz Sicherheitsschaltung richtig einstellen
Fehlschaltung, sporadisch	Dichter schwerer Schaum, wilde Turbulenzen, aufgeschäumte Flüssigkeit	Liquiphant im Bypass montieren
	Extreme Funkstörung	Verbindungskabel abschirmen
	Extreme Vibrationen	Entkoppeln, dämpfen, Schwinggabel 90° drehen
	Wasser im Gehäuse	Deckel und Kabeldurchführungen fest zuschrauben
	FEL52: Ausgang überlastet	Last, (Leitungs-) Kapazität verringern
Fehlschaltung nach Netzausfall	FEL57, Verhalten beim Einschalttest (wiederkehrende Prüfung)	Schaltverhalten FEL57 beachten; Anlagensteuerung nach Netzausfall bis ca. 45 s blockieren

Fault	Reason	Remedy
Does not switch	No power	Check power
	Faulty signal line	Check signal line
	Faulty electronic insert - FEL51 connected directly to L1 and N	Exchange - always connect FEL51 via external load
	Density of liquid too low	Set density to > 0.5 at electronic insert
	Fork encrusted	Clean fork
	Fork corroded (Indication on FEL: red/yellow flashes, FEL58: green flashes 0.3 Hz)	Exchange fork and process connection
	FEL51: Internal resistance of connected relay too large	Connect suitable relay
	FEL51: Holding current of connected relay too low	Connected resistor in parallel with relay
	FEL54: Contacts welded together (after short-circuit)	Exchange FEL54; put fuse in contact circuit
Switches incorrectly	Min-/Max- fail-safe mode set wrongly	Set correct mode at electronic insert
Sporadic faulty switching	Thick heavy foam, very turbulent conditions, foaming liquid	Mount Liquiphant in bypass
	Extreme RFI	Use screened cable
	Extreme vibration	Decouple, damp, turn fork 90°
	Water in housing	Screw cover and cable gland tight
	FEL52: Output overloaded	Reduce load,(cable) capacitance
Switches incorrectly after power failure	FEL57, behaviour during switch-on test (functional test)	Observe switching behaviour of FEL57; After power failure blockplant control for up to 45 s

fr - Recherche de défauts

Défaut	Cause	Mesure
Ne commute pas	Tension d'alimentation manquante	Vérifier la tension d'alimentation
	Câble de signal défectueux	Vérifier le câble de signal
	Electronique défectueuse – FEL51 relié directement á L1 et N	Remplacer – Relier FEL51 toujours via la charge externe
	Densité du liquide trop faible	Régler la densité sur > 0,5 sur l'électronique
	Lames vibrantes encroûtées	Nettoyer les lames vibrantes
	Lames vibrantes corrodées (Sur FEL: rouge/jaune clignote, FEL58: vert clignote 0,3 Hz)	Remplacer les lames vibrantes ainsi que le raccord process
	FEL51: relais avec résistance interne trop élevée	Raccorder un relais approprié
	FEL51: relais avec courant de maintien trop faible	Raccorder une résistance en parallèle au relais
	FEL54: contacts soudés (après un court-circuit)	Remplacer FEL54; fusible dans le circuit courant
Mauvaise commutation	Sécurité min/max inversée	Régler correctement le circuit de sécurité sur l'électronique
Mauvaise commutation, sporadique	Mousse dense et lourde, fortes turbulences, liquide émulsionné	Monter le Liquiphant en bypass
	Parasites puissants	Blinder le câble de liaison
	Vibrations importantes	Découpler, amortir, tourner la fourche de 90°
	Eau dans le boîtier	Visser fermement le couvercle et les entrées de câble
	FEL52: surcharge de la sortie	Réduire la charge et la capacité (de ligne)
Mauvaise commutation après coupure	FEL57, comportement lors du test de mise sous tension (test cyclique)	Observer le comportement du FEL57 à la mise sous tension; bloquer la commande de l'installation après coupure de courant pendant max. 45 s

Fallo	Causa	Solución
No conmuta	No hay alimentación	Comprobar alimentación
	Señal defectuosa	Comprobar cable de señal
	Electrónica defectuosa – FEL51 conectada directamente a L1 y N	Cambio – Siempre conectar FEL51 vía una carga externa
	Densidad del líquido demasiado baja	Fijar densidad a > 0.5 en la electrónica
	Horquillas con adherencias	Limpiar horquillas
	Horquillas corroidas (En FEL: rojo/amarillo parpadea, FEL58: verde parpadea 0.3 Hz)	Cambiar la horquilla y la conexión a proceso
	FEL51: Relé con resistencia interna demasiado grande	Conectar un relé adecuado
	FEL51: El relé conectado retiene muy poca corriente	Resistencia conectada en paralelo con el relé
	FEL54: Contactos soldados juntos (después del corto circuito)	Cambiar FEL54; poner fusible en el circuito de contacto
Conmuta incorrectamente	El modo de fallo mín./máx. está mal ajustado	Ajustar el modo correcto en la electrónica
Fallos de conmutación esporádicos	Espuma muy densa, turbulencias, líquidos espumosos	Montar el Liquiphant en bypass
	RFI extremo	Utilizar cable apantallado
	Vibraciones extremas	Desacoplar, amortiguar y girar las horquillas 90°
	Agua en el cabezal	Roscar la cubierta y el prensaestopas firmemente
	FEL52: Salida con sobretensión	Reducir carga, capacidad (cable)
Conmuta incorrectamente después de un fallo de alimentación	FEL57, comportamiento durante la comprobación de conmutación (test de funcionamiento)	Observar el comportamiento de conmutación del FEL57; del fallo de alimentación, bloqueo del control de la planta durante 45 s aprox.

it – Individuazione e eliminazione delle anomalie

Guasto	Motivo	Rimedio
Non commuta	Mancanza alimentazione	Controllare l'alimentazione
	Linea segnale guasta	Controllare segnale linea
	Inserto elettronico guasto – FEL51 connesso direttamente a L1 e N	Sostituire - connettere sempre FEL51 mediante carico esterno
	Densità del liquido troppo bassa	Impostare la densità a > 0,5 sull'inserto elettronico
	Forcella incrostata	Pulire la forcella
	Forcella corrosa (Sul FEL: rosso/giallo lampeggiano, FEL58: verde lampeggiano 0,3 Hz)	Sostituire la forcella e la connessione al processo
	FEL51: resistenza interna del relè connesso troppo grande	Collegare il relè adeguato
	FEL51: corrente di mantenimento del relè connesso troppo grande	Connettere resistenza in parallelo al relè
	FEL54: contatti saldati insieme (dopo il corto circuito)	Sostituire FEL54; mettere il fusibile nel circuito di contatto
Commuta non correttamente	Modalità di sicurezza min-/max-impostata in modo errato	Impostare la modalità corretta nell'inserto elettronico
Commutazione sporadicamente difettosa	Schiuma pesante e torbida condizioni molto turbolente, liquido che produce schiuma	Montare il Liquiphant nel bypass
	RFI forte	Usare cavo schermato
	Forte vibrazione	Disaccoppiare, smorzare, ruotare la forcella di 90°
	Acqua nella custodia	Avvitare correttamente il coperchio e il passacavi
	FEL52: Uscita sovraccaricata	Ridurre il carico, capacità (cavo)
Commutazione non corretta dopo la mancanza alimentazione	FEL57, comportamento durante la fase di test all'accensione (test di funzionamento)	Osservare il comportamento di commutazione del FEL57; dopo il ripristino di una mancanza di alimentazione inibire il controllo dell'impianto per 45 s

Fout	Oorzaak	Maatregel
Schakelt niet	Voeding ontbreekt	Voeding kontroleren
	Signaalleiding defect	Signalleiding kontroleren
	Insert defect - FEL51 direct op L1 en N aangesloten	Ver vangen - FEL51 altijd via een belasting aansluiten
	Dichtheid van de vloeistof te gering	Op elektronica- insert dichtheid op > 0, 5 instellen
	Trilvork te veel vervuild	Trilvork reinigen
	Trilvork gecorrodeerd (LED op FEL knippert rood/geel, FEL58: groen knippert 0,3 Hz)	Trilvork compleet met procesaansluiting vervangen
	FEL51: Relais met te groteinwendige weerstand aangesloten	Passender relais aansluiten
	FEL51: Relais met te geringe houdstroom aangesloten	Weerstand parallel aan relais aansluiten
	FEL54: Contacten verkleeft (na een kortsluiting)	FEL54 vervangen; zekering in circuit aanbrengen
Schakelt foutief	Minimum- /Maximum- fail-safe instelling verwisseld	FEL fail-safe keuze correct instellen
Sporadische foutschakeling	Dik zwaar schuim, wilde turbulentie, opgeschuimde vloeistof	Liquiphant in by-pass monteren
	Extreme RFI invloed	Verbindingskabel afschermen
	Extreme vibraties	Ontkoppelen, dempen, vork 90° draaien
	Water in de behuizing	Deksel en wartels vast aandraaien
	FEL52: uitgang overbelast	Schakelbelasting verminderen
Foutmelding	FEL57, gedrag bij inschakelen na netuitval (periodieke testfunctie)	Schakelgedrag FEL57 controleren; procesherstart na netuitval ca. 45 s blokkeren

de – Ergänzung Fehlersuche

Ist das Schaltverhalten der Gabel ungewöhnlich, kann an PIN 4 der Diagnosebuchse die Gabelfrequenz gemessen werden.
Bei den Elektronikeinsätzen FEL51/52/54/55/56/57/58 ist dies eine sinusförmige Schwingung deren Amplitude einen Rückschluss auf den Gabelzustand zulässt.
Bei FEL50A ist aufgrund eines Rechtecksignals nur noch die Gabelfrequenzmessung möglich.

en – Trouble- shooting Supplement

If the switching behaviour of the fork is abnormal, the fork frequency can be measured at PIN 4 of the diagnosis socket.
With electronic inserts FEL51/52/54/55/56/57/58 this is a sinusoidal vibration whose amplitude makes it possible to determine the condition of the fork.
With FEL50A, only the fork frequency measurement is possible due to a rectangular pulse signal.

fr – Additif recherche de défauts

Si la commutation de la fourche est inhabituelle, il est possible de mesurer la fréquence de cette dernière au PIN 4 de la prise diagnostic.
Pour l es électroniques FEL51/52/54/55/56/57/58 il s'agit d'une oscillation sinusoïdale dont l'amplitude permet d'évaluer l'état de la fourche.
Pour FEL50A, le signal rectangulaire ne permet qu'une mesure de la fréquence de fourche.

es – Suplemento para la identificación de fallos

Si el comportamiento de conmutación de la horquilla es anormal, puede medir la frecuencia de la misma en el PIN 4 del interruptor de diagnosis.
Con las electrónicas FEL51/52/54/55/56/57/58 se consigue una vibración sinusoidal cuya amplitud hace posible determinar la condición de la horquilla.
Con FEL50A, sólo es posible medir la frecuencia de la horquilla debido a una señal de impulsos rectangular.

it – Supplemento alla ricerca dei malfunzionamenti

Se le condizioni di commutazione dei rebbi non è normale la frequenza di vibrazione può essere misurata al PIN 4 del connettore per la diagnosi.
Con gli inserti elettronici FEL51/52/54/55/56/57/58 è possibile determinare la condizione dei rebbi anche tramite l'ampiezza dell'onda sinusoidale.
Con FEL50A il segnale è un onda quadra, per cui è possibile valutare solo il valore di frequenza.

nl – Bijlage problemen oplossen

Indien het schakelgedrag van de trilvork niet normaal verloopt kan de frequentie van de vork gemeten worden op pen 4 van de diagnoseconnector.
Bij de elektronica inserts van de FEL51/52/54/55/56/57/58 is dit een sinusvormige trilling waarvan de amplitude een beeld geeft van de conditie van de vork.
Bij de FEL50A is alleen de vorkfrequentie te meten als gevolg van een rechthoekig pulssignaal.

de - Ersatzteile
Elektronikeinsätze

en - Spare parts
Electronic inserts

fr - Pièces de rechange
Electroniques

es - Repuestos
Electrónicas

it - Ricambi
Inserti elettronici

nl - Reserve-onderdelen
Elektronica inserts

FEL51	52002304
FEL52	52002305
FEL54	52002306
FEL55	52002307
FEL56	52002308
FEL57	52002309
FEL58	52006454
FEL50A	52010527

Installationsregel: Bei der Installation ist zu beachten, dass elektrische Betriebsmittel (Elektronikeinsätze) die mit nichteigensicheren Stromkreisen gespeist wurden, grundsätzlich **nicht** mehr mit eigensicheren Stromkreisen zusammengeschaltet werden dürfen.

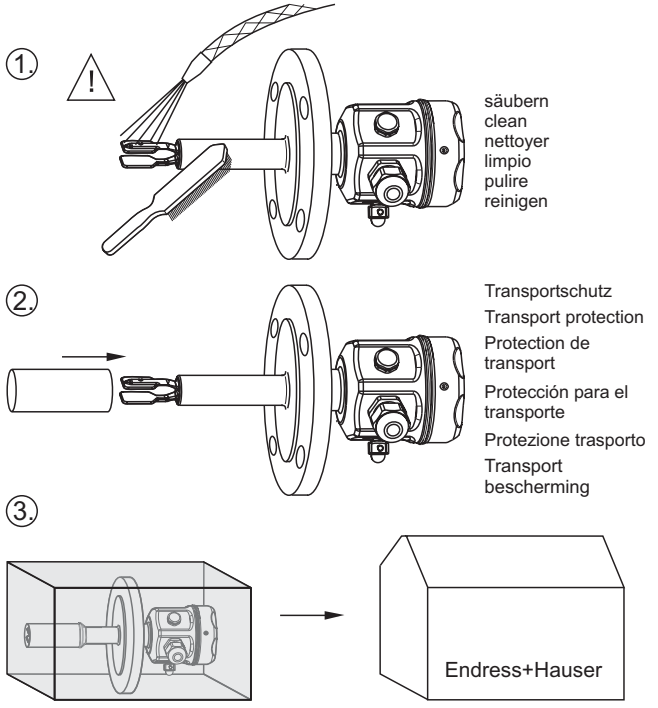
Installation specification: During installation, please keep in mind that electrical resources (electronic inserts) which are powered by non-intrinsically-safe circuits may **no** longer be interconnected with intrinsically-safe circuits.

Directive d'installation : Lors de l'installation, tenir compte du fait que les matériels électriques (électroniques) alimentés par des circuits sans sécurité intrinsèque **ne** doivent plus être connectés à des circuits à sécurité intrinsèque.

Normas de instalación: Durante la instalación, tenga en cuenta que los elementos eléctricos (electrónicas) alimentadas por circuitos no instrínsecamente seguros, **no** podrán estar interconectadas con circuitos intrínsecamente seguros.

Specifiche di installazione: Durante l'installazione è necessario tenere presente che gli impianti elettrici (inserti elettronici) alimentati da circuiti elettrici non a sicurezza intrinseca **non** possono più essere collegati con circuiti elettrici a sicurezza intrinseca.

Installatievoorschrift: Bij de installatie moet erop worden gelet, dat elektrisch materieel (elektronica-units) die via niet-intrinsiekveilige circuits worden gevoed, in principe **niet** meer met intrinsiekveilige circuits mogen worden samengeschakeld.



de - Reparatur
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en - Repair
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fr - Réparations
chez Endress+Hauser

es - Reparaciones
en Endress+Hauser

it - Riparare
presso la Endress+Hauser

nl - Reparatie
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de- Ergänzende Dokumentation

en - Supplementary Documentation

fr - Documentation complémentaire

es - Documentación adicional

it - Documentazione supplementare

nl - Aanvullende documentatie

Technische Information / Technical Information / Information technique / Información técnica / Informazioni tecniche / Technische Informatie

TI328F	Liquiphant FTL50, FTL50H, FTL51, FTL51H
TI426F	Weld-in adapter, leven and pressure

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KA143F/00/a6/07.10, 71118926, CCS/FM6

71118926

INFORMAZIONI TECNICHE

Technical Information

Liquiphant M
FTL50, FTL51, FTL50H, FTL51H

Vibronic

Point level switch for all kinds of liquids

Application

- Process temperatures from −50 °C to 150 °C (-58 to 302 °F)
- Pressures up to 100 bar (1450 psi)
- Viscosities up to 10,000 mm^2/s (cSt)
- For liquids with densities ≥ 0.5 g/cm^3(SGU)

FTL50: Compact design
FTL51: Extension pipe up to 3 m (9.8 ft) and up to 6 m (20 ft) on request
FTL50H, FTL51H: Certified for the food and pharmaceutical industries

Ideal substitute for float switches, as reliable function not affected by flow, turbulence, bubbles, foam, vibration, solids content or buildup.

Your benefits

- Recommended for safety systems requiring functional safety to SIL2/SIL3 as per IEC 61508/IEC 61511-1
- Design in accordance with ASME B31.3
- Recommended for use in sterile applications in the life science industry (design in accordance with ASME BPE)
- No adjustment: quick, low-cost startup
- No mechanically moving parts: no maintenance, no wear, long operating life
- Functional safety: Monitoring of tuning fork for damage
- Compact stainless steel housing (optional): the IP69K protection rating guarantees that the unit remains impermeable, even in the event of intensive cleaning or flooding for several hours.

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People for Process Automation

Table of contents

Application 4
Point level detection 4

Function and system design 4
Measuring principle 4
Modularity 4
Electronic versions 5
Electronics for continuous density measurement 5
Galvanic isolation 5
Design 5

Input 5
Measured variable 5
Measuring range (detection range) 5
Density 5

Electronic insert FEL51 (AC 2-wire) 6
Power supply 6
Electrical connection 6
Output signal 6
Signal on alarm 6
Connectable load 6

Electronics FEL51 (AC, in compact housing) 8
Power supply 8
Electrical connection 8
Output signal 8
Signal on alarm 8
Connectable load 8

Electronic insert FEL52 (DC PNP) 10
Power supply 10
Electrical connection 10
Output signal 10
Signal on alarm 10
Connectable load 10

Electronics FEL52 (DC PNP, in compact housing) . . 11
Power supply 11
Electrical connection 11
Output signal 11
Signal on alarm 12
Connectable load 12

Electronic insert FEL54 (AC/DC with relay output). 13
Power supply 13
Electrical connection 13
Output signal 13
Signal on alarm 13
Connectable load 13

Electronic insert FEL55 (8/16 mA) 14
Power supply 14
Electrical connection 14
Output signal 14
Signal on alarm 14
Connectable load 14

Electronic insert FEL56 (NAMUR L-H edge) 15
Power supply 15
Electrical connection 15
Output signal 15
Signal on alarm 15
Connectable load 15

Electronic insert FEL58 (NAMUR H-L edge) 16
Power supply 16
Electrical connection 16
Output signal 16
Signal on alarm 16
Connectable load 16

Electronics FEL58 (NAMUR H-L edge, in compact housing) 17
Power supply 17
Electrical connection 17
Output signal 17
Signal on alarm 17
Connectable load 17

Electronic insert FEL57 (PFM) 18
Power supply 18
Electrical connection 18
Output signal 19
Signal on alarm 19
Connectable load 19

Electronic insert FEL50A (PROFIBUS PA) 20
Power supply 20
Electrical connection 20
Output signal 21
Signal on alarm 21

Electronic insert FEL50D (density) 22
Power supply 22
Electrical connection 22
Signal on alarm 22
Adjustment 22
Operating principle 23
Light signals 23

Connection and function 24
Connecting cables 24
Safety mode 24
Switching time 24
Switch-on behavior 24

Performance characteristics 24
Reference operating conditions 24
Maximum measured error 24
Repeatability 24
Hysteresis 24

Influence of medium temperature 24
Influence of medium density 24
Influence of medium pressure 24

Operating conditions 25
Installation 25
Examples of mounting 25
Orientation 27

Environment 27
Ambient temperature range 27
Storage temperature 27
Installation height as per IEC61010-1 Ed.3 27
Climate class 27
Degree of protection 28
Vibration resistance 28
Electromagnetic compatibility 28

Medium conditions 29
Medium temperature 29
Thermal shock 29
Medium pressure pe 29
Test pressure 29
State of aggregation 29
Density 29
Viscosity 29
Solids content 29
Lateral loading capacity 29

Mechanical construction 30
Design 30
Dimensions 31
Weights 36
Materials and surfaces 36
Process connections 37

Human interface 38
Electronic inserts 38
Compact housing 39
Operating concept 41

Certificates and approvals 41
CE mark 41
C-tick mark 41
General approvals 41
CRN approval 42
Process seal according to ANSI/ISA 12.27.01 42
Other certificates 42
Manufacturer declarations 42
Use in hazardous zones 42
ASME B 31.3 43
Pressure equipment directive 43

Ordering information 43
Liquiphant M FTL50, FTL51 product structure 43
Liquiphant M FTL50H, FTL51H product structure 47

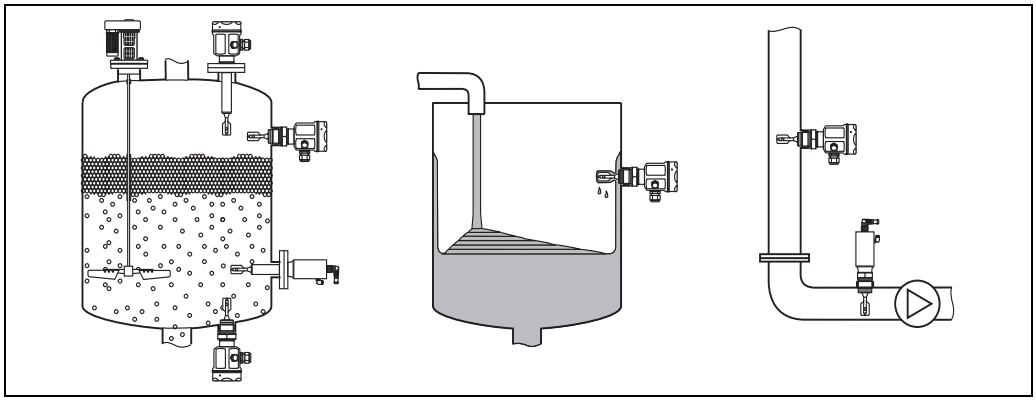
Accessories 50
Weld-in adapter 50
Weather protection cover 52
Lap joint flange 52
Lap joint flanges 53
Sliding sleeves for unpressurized operation 53
High pressure sliding sleeves 54
Cover with sight glass 55
Cover with sight glass 55
Circular connector 55

Documentation 56
Operating Instructions 56
Technical Information 57
Functional safety (SIL) 57
Safety Instructions (ATEX) 58
Safety Instructions (NEPSI) 58
Control Drawings 58
System information 58

Application

Point level detection

Maximum or minimum detection in tanks or pipes containing all kinds of liquids, including use in hazardous areas, food and pharmaceuticals.



L00-FTL5xxxx-11-05-xx-xx-000

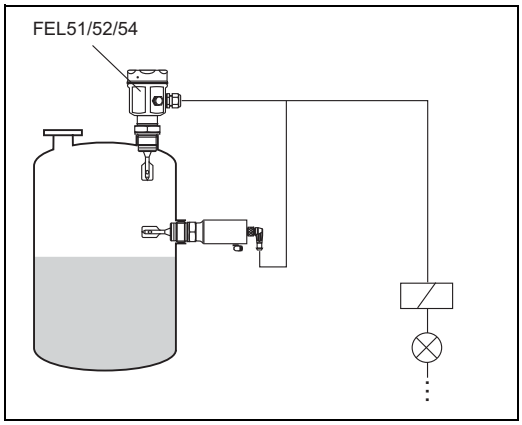
Function and system design

Measuring principle

The sensor's fork vibrates at its intrinsic frequency. This frequency is reduced when covered with liquid. This change in frequency causes the point level switch to switch.

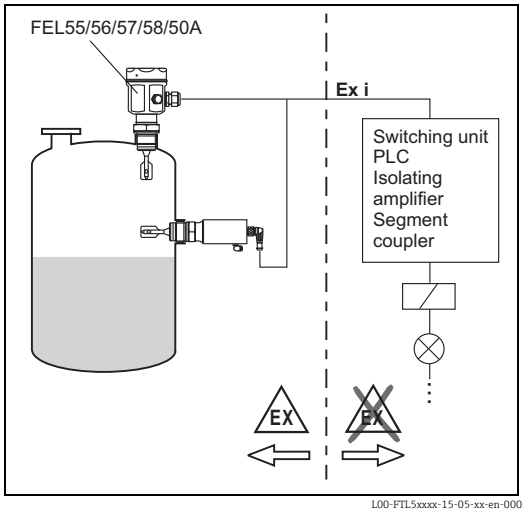
Modularity

Point level switch
Liquiphant M FTL with electronic versions
FEL51, FEL52, FEL54



L00-FTL5xxxx-15-05-xx-xx-000

Point level switch
Liquiphant M FTL with electronic versions
FEL55, FEL56, FEL57, FEL58
for connecting to a separate switching unit
or an isolating amplifier FEL50A
for connecting to a PROFIBUS PA segment



L00-FTL5xxxx-15-05-xx-en-000

Electronic versions	FEL51: Two-wire AC version; Switches the load directly into the power supply circuit via an electronic switch. FEL52: Three-wire DC version; Switches the load via the transistor (PNP) and separate connection e.g. in conjunction with programmable logic controllers (PLCs), DI modules as per EN 61131-2. FEL54: Universal current version with relay output; Switches the loads via 2 floating change-over contacts. FEL55: Signal transmission 16/8 mA on two-wire cabling e.g. in conjunction with programmable logic controllers (PLCs), AI modules 4 to 20 mA as per EN 61131-2. FEL56: For separate switching unit; signal transmission L-H edge 0.6 to 1.0 / 2.2 to 2.8 mA to EN 50227 (NAMUR) on two-wire cabling. FEL58: For separate switching unit; signal transmission H-L edge 2.2 to 3.5 / 0.6 to 1.0 mA to EN 50227 (NAMUR) on two-wire cabling. Checking of connecting cabling and other devices by pressing a key on the electronic insert. FEL57: For separate switching unit; PFM signal transmission; Current pulses superposed on the power supply along the two-wire cabling. Proof test from the switching unit without changing levels. FEL50A: For connecting to PROFIBUS PA; Cyclic and acyclic data exchange acc. to PROFIBUS-PA Profile 3.0 Discrete Input
Electronics for continuous density measurement	FEL50D: For connecting to Density Computer FML621
Galvanic isolation	FEL51, FEL52, FEL50A: between sensor and power supply FEL54: between sensor and power supply and load FEL55, FEL56, FEL57, FEL58, FEL50D: see connected switching unit
Design	FTL50: Compact FTL51: With extension pipe FTL50H: Compact, with polished tuning fork and hygienic process connections FTL51H: With extension pipe, polished tuning fork and hygienic process connections

Input

Measured variable	Level (limit value)
Measuring range (detection range)	FTL50: dependent on mounting point FTL51: dependent on mounting point and the extension pipe ordered. Standard extension pipe up to 3 m (9.8 ft) and up to 6 m (20 ft) on request.
Density	Setting on the electronic insert > 0.5 g/cm³ (SGU) or > 0.7 g/cm³ (SGU) (others on request)

Electronic insert FEL51 (AC 2-wire)

Power supply

Supply voltage: AC 19 to 253 V
Power consumption: < 0.83 W
Residual current consumption: < 3.8 mA
Short-circuit protection
Overvoltage protection FEL51: overvoltage category III

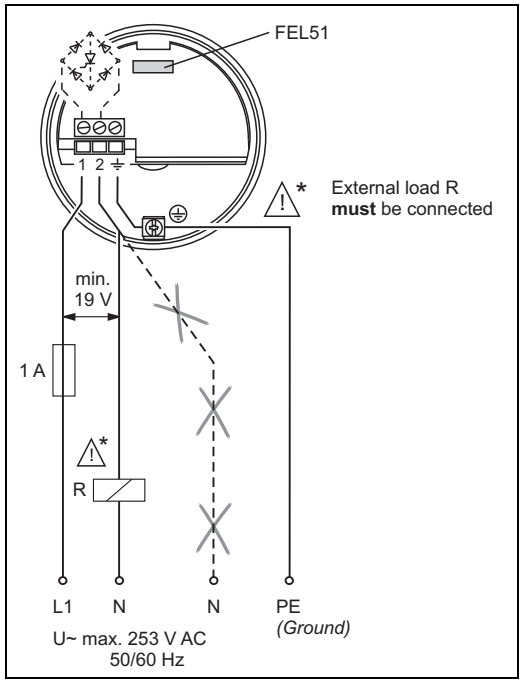
Electrical connection

Two-wire AC connection

Switches the load directly into the power supply circuit via an electronic switch.

Always connect in series with a load!

Check the following:
- The residual current in blocked state (up to 3.8 mA)
- That for low voltage
  - the voltage drop across the load is such that the minimum terminal voltage at the electronic insert (19 V) when blocked is not undershot.
  - the voltage drop across the electronics when switched through is observed (up to 12 V)
- That a relay cannot de-energize with holding power below 3.8 mA.
  If this is the case, a resistor should be connected parallel to the relay. An RC module is available under the part number: 71107226
- When selecting the relay, pay attention to the holding power / rated power (see "Connectable load")



L00-FTL5xxxx-04-05-xx-en-007

Output signal

I_L = load current (switched through)

< 3.8 mA = residual current (blocked)

☼ = lit

● = unlit

L00-FTL2xxxx-07-05-xx-xx-000

Safety mode	Level	Output signal	LEDs green	LEDs red
Max.		1 —I_L→ 2	☼	●
		1 - - < 3.8 mA - - → 2	☼	☼
Min.		1 —I_L→ 2	☼	●
		1 - - < 3.8 mA - - → 2	☼	☼

L00-FTL5xxxx-04-05-xx-xx-001

Signal on alarm

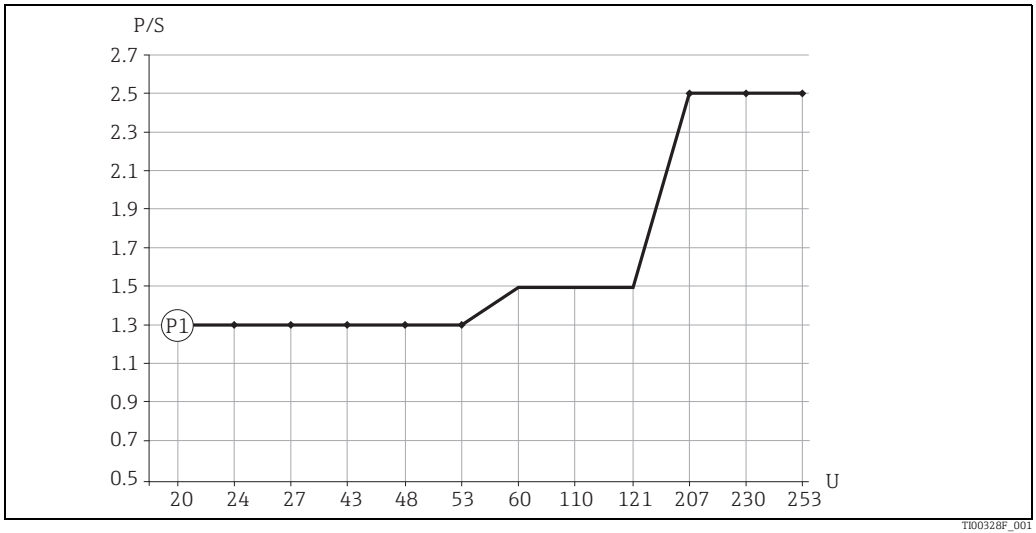
Output signal on power failure or in the event of damaged sensor: < 3.8 mA

Connectable load

- Voltage drop via FEL51 ≤ 12 V
- Residual current if electrical switch is blocked: ≤ 3.8 mA
- Load switched directly into the power supply circuit via the thyristor.
  Transient (40 ms) ≤ 1.5 A, ≤ 375 VA at 253 V or ≤ 36 VA at 24 V (not short-circuit-proof)

The load is switched via an electronic switch directly in the power circuit.
Always connect in series with a load!
Not suitable for connection to low-voltage PLC inputs!

Selection guide for relays



Minimum nominal power of load
P/S nominal power in [W] / [VA]
U operating voltage in [V]

Position	Operating voltage	Nominal power	
		min.	max.
P1	24 V	> 1.3 VA	< 6 VA
AC operation	110 V	> 1.5 VA	< 27.5 VA
	230 V	> 2.5 VA	< 57.5 VA

Relays with less nominal power can be operated via an RC module connected in parallel (optional).

Electronics FEL51 (AC, in compact housing)

Power supply

Supply voltage: AC 19 to 253 V
Power consumption: < 0.83 W
Residual current consumption: < 3.8 mA
Short-circuit protection
Overvoltage protection FEL51: overvoltage category III

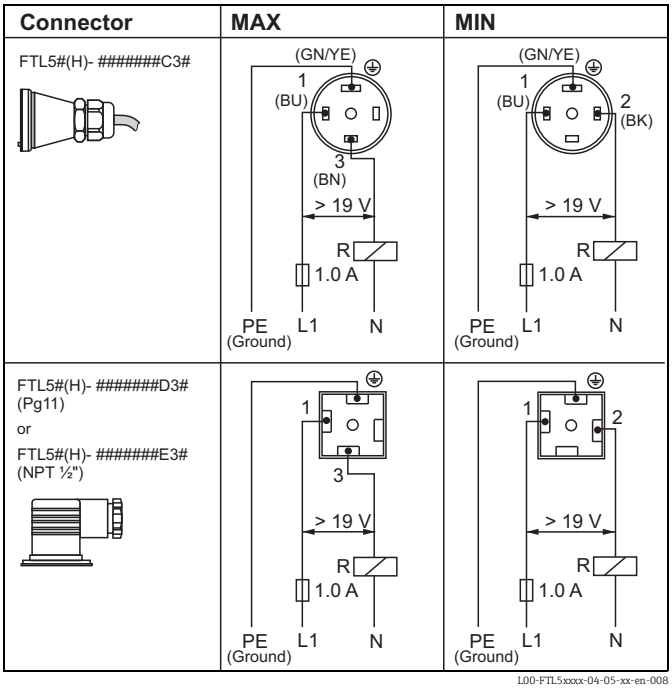
Electrical connection

Two-wire AC connection

Switches the load directly into the power supply circuit via an electronic switch.

Always connect in series with a load!

Check the following:
- The residual current in blocked state (up to 3.8 mA)
- That for low voltage
  - the voltage drop across the load is such that the minimum terminal voltage at the electronic insert (19 V) when blocked is not undershot.
  - the voltage drop across the electronics when switched through is observed (up to 12 V)



L00-FTL5xxxx-04-05-xx-en-008

- That a relay cannot de-energize with holding power below 3.8 mA.
  If this is the case, a resistor should be connected parallel to the relay (e.g. RC module: part number 71107226).

Output signal

I_L = load current (switched through)

< 3.8 mA = residual current (blocked)

☼ = lit

● = unlit

L00-FTL2xxxx-07-05-xx-xx-000

Safety mode	Level	Output signal	LEDs green	LEDs red
Max.		1 —I_L→ 3	☼	●
		1 --< 3.8 mA--> 3	☼	☼
Min.		1 —I_L→ 2	☼	●
		1 --< 3.8 mA--> 2	☼	☼

L00-FTL5xxxx-04-05-xx-xx-001a

Signal on alarm

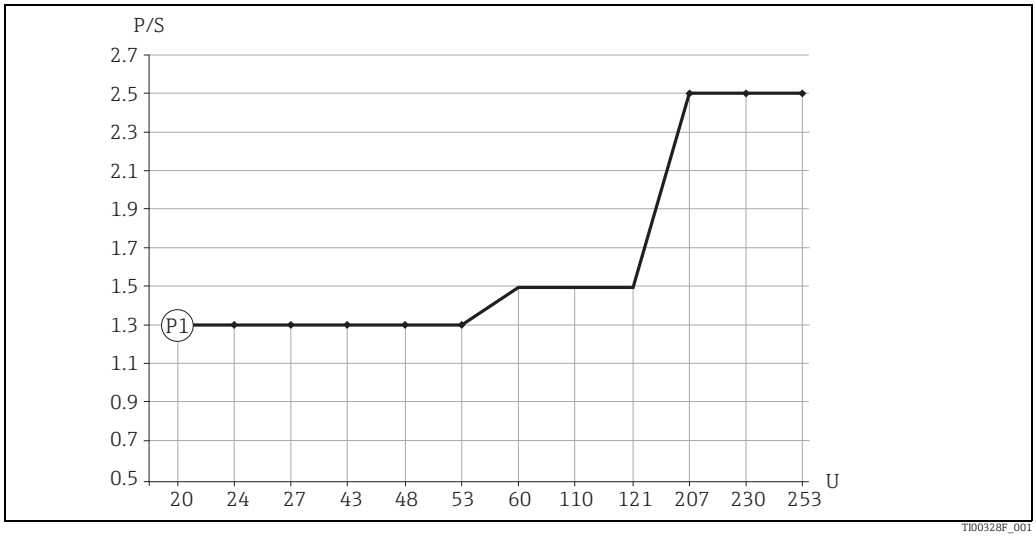
Output signal on power failure or in the event of damaged sensor: < 3.8 mA

Connectable load

- Voltage drop via FEL51 ≤ 12 V
- Residual current if electrical switch is blocked: ≤ 3.8 mA
- Load switched directly into the power supply circuit via the thyristor.
  Transient (40 ms) ≤ 1.5 A, ≤ 375 VA at 253 V or ≤ 36 VA at 24 V (not short-circuit-proof)

The load is switched via an electronic switch directly in the power circuit.
Always connect in series with a load!
Not suitable for connection to low-voltage PLC inputs!

Selection guide for relays



Minimum nominal power of load
P/S nominal power in [W] / [VA]
U operating voltage in [V]

Position	Operating voltage	Nominal power	
		min.	max.
P1 AC operation	24 V	> 1.3 VA	< 6 VA
	110 V	> 1.5 VA	< 27.5 VA
	230 V	> 2.5 VA	< 57.5 VA

Relays with less nominal power can be operated via an RC module connected in parallel (optional).

Electronic insert FEL52 (DC PNP)

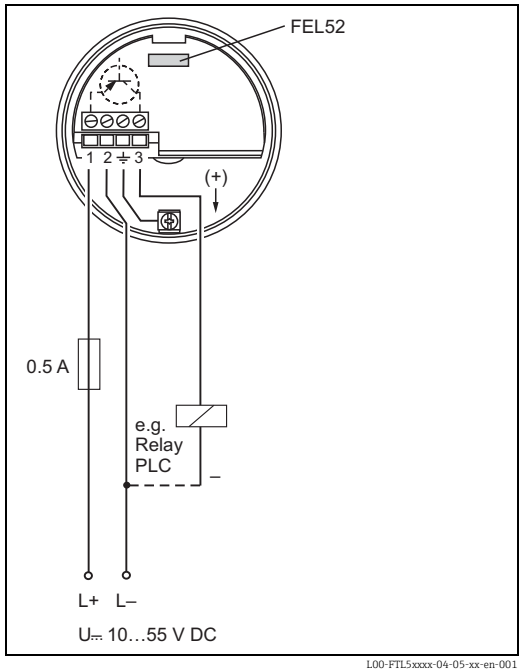
Power supply

Supply voltage: DC 10 to 55 V
Ripple: ≤ 1.7 V, 0 to 400 Hz
Current consumption: ≤ 15 mA
Power consumption: ≤ 0.83 W
Reverse polarity protection
Overvoltage protection FEL52: overvoltage category III

Electrical connection

Three-wire DC connection

Switches the load via the transistor (PNP) and separate connection.
Preferably used with programmable logic controllers (PLC),
DI modules as per EN 61131-2.
Positive signal at switching output of the electronics (PNP); Output blocked on reaching point level.



L00-FTL5xxxx-04-05-xx-en-001

Output signal

I_L = load current (switched through)

< 100 µA = residual current (blocked)

☼ = lit

● = unlit

L00-FTL2xxxx-07-05-xx-xx-000

Safety mode	Level	Output signal	LEDs green	LEDs red
Max.		L+ 1 → I_L → + 3	☼	●
		1 - - < 100 µA → 3	☼	☼
Min.		L+ 1 → I_L → + 3	☼	●
		1 - - < 100 µA → 3	☼	☼

L00-FTL5xxxx-04-05-xx-xx-004

Signal on alarm

Output signal on power failure or in the event of damaged sensor: < 100 µA

Connectable load

- Load switched via the transistor and separate PNP connection, ≤ DC 55 V
- Load current ≤ 350 mA (pulsed overload and short-circuit protection)
- Residual current < 100 µA (with transistor blocked).
- Capacitance load ≤ 0.5 µF at 55 V, ≤ 1.0 µF at 24 V
- Residual voltage < 3 V (with transistor switched through);

Electronics FEL52 (DC PNP, in compact housing)

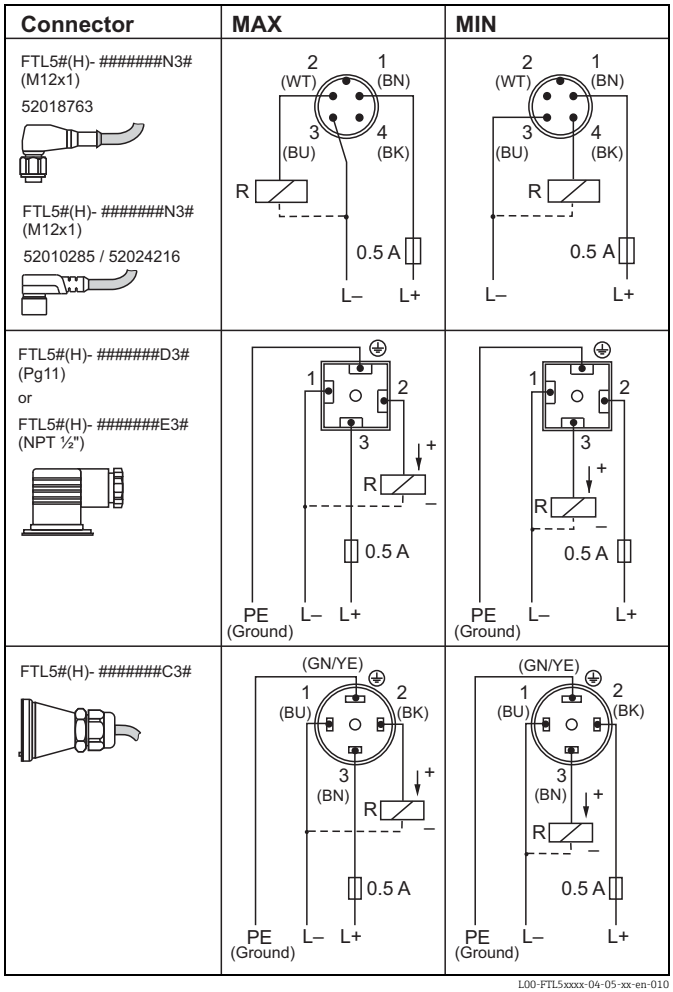
Power supply

Supply voltage: DC 10 to 55 V
Ripple: ≤ 1.7 V, 0 to 400 Hz
Current consumption: ≤ 15 mA
Power consumption: ≤ 0.83 W
Reverse polarity protection
Overvoltage protection FEL52: overvoltage category III

Electrical connection

Three-wire DC connection

Preferably used with programmable logic controllers (PLC), DI module as per EN 61131-2. Positive signal at switching output of the electronics (PNP); Output blocked on reaching point level.



L00-FTL5xxxx-04-05-xx-en-010

Output signal

With valve connector or cable tail

I_L = load current (switched through)

< 100 µA = residual current (blocked)

☼ = lit

● = unlit

L00-FTL2xxxx-07-05-xx-xx-000

Safety mode	Level	Output signal	LEDs green	LEDs red
Max.		L+ 3 → I_L → 2 +	☼	●
		L+ 3 --- < 100 µA → 2 +	☼	☼
Min.		L+ 2 → I_L → 3 +	☼	●
		L+ 2 --- < 100 µA → 3 +	☼	☼

L00-FTL5xxxx-04-05-xx-xx-004a

With M12x1 connector 52010285 / 52024216 (without LEDs)

L00-FTL5xxxx-16-05-xx-xx-002

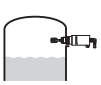
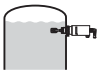
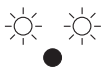
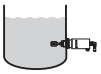
I_L = load current (switched through)

< 100 µA = residual current (blocked)

☼ = lit

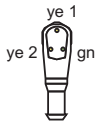
● = unlit

L00-FTL2xxxx-07-05-xx-xx-000

Safety mode	Level	Output signal	LEDs
Max.		L+ 1 —I_L→ – 2	
		L+ 1 - - < 100 µA → – 2	
Min.		L+ 1 —I_L→ – 4	
		L+ 1 - - < 100 µA → – 4	

L00-FTL5xxxx-04-05-xx-xx-010

With M12x1 connector 52018763 (with LEDs)



L00-FTL5xxxx-16-05-xx-xx-001

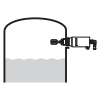
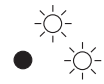
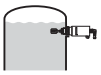
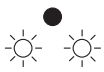
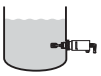
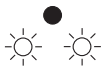
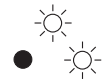
I_L = load current (switched through)

< 100 µA = residual current (blocked)

☼ = lit

● = unlit

L00-FTL2xxxx-07-05-xx-xx-000

Safety mode	Level	Output signal	LEDs
Max.		L+ 1 —I_L→ – 2	
		L+ 1 - - < 100 µA → – 2	
Min.		L+ 1 —I_L→ – 4	
		L+ 1 - - < 100 µA → – 4	

L00-FTL5xxxx-04-05-xx-xx-011

Signal on alarm

Output signal on power failure or in the event of damaged sensor: < 100 µA

Connectable load

- Load switched via the transistor and separate PNP connection, ≤ DC 55 V
- Load current ≤ 350 mA (pulsed overload and short-circuit protection)
- Residual current < 100 µA (with transistor blocked).
- Capacitance load ≤ 0.5 µF at 55 V, ≤ 1.0 µF at 24 V
- Residual voltage < 3 V (with transistor switched through);

Electronic insert FEL54 (AC/DC with relay output)

Power supply

Supply voltage: AC 19 to 253 V, 50/60 Hz or DC 19 to 55 V
Power consumption: ≤ 1.3 W
Reverse polarity protection
Overvoltage protection FEL54: overvoltage category III

Electrical connection

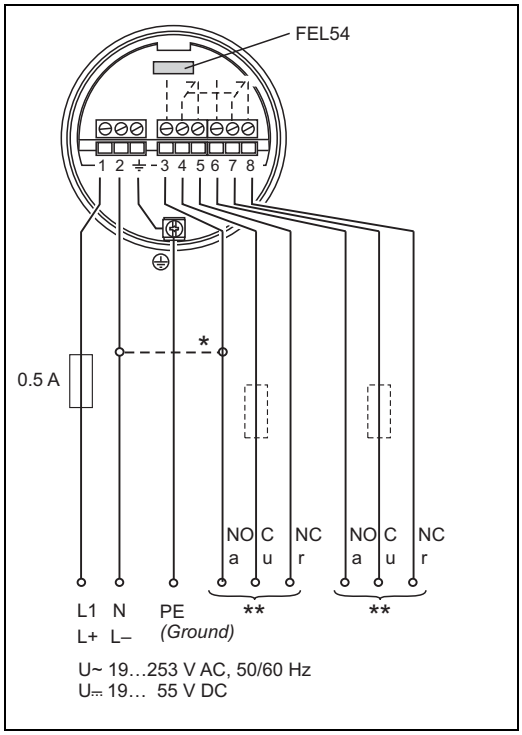
Universal current connection with relay output

Power supply:
Please note the different voltage ranges for AC and DC.

Output:
When connecting an instrument with high inductance, provide a spark arrester to protect the relay contact.
A fine-wire fuse (depending on the load connected) protects the relay contact on short-circuiting.
Both relay contacts switch simultaneously.

* When jumpered, the relay output works with NPN logic.

** See "Connectable load"

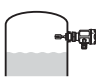
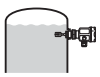
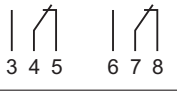
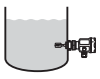
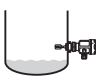


L00-FTL5xxxx-04-05-xx-xx-002

Output signal

= relay energized
= relay de-energized
= lit
= unlit

L00-FTL2xxxx-07-05-xx-xx-001

Safety mode	Level	Output signal	LEDs green	LEDs red
Max.		3 4 5 6 7 8	☼	●
		 3 4 5 6 7 8	☼	☼
Min.		3 4 5 6 7 8	☼	●
		3 4 5 6 7 8	☼	☼

L00-FTL5xxxx-04-05-xx-xx-005

Signal on alarm

Output signal on power failure or in the event of damaged sensor: relay de-energized

Connectable load

- Loads switched via 2 floating change-over contacts (DPDT).
- I~ ≤ 6 A (Ex de 4 A), U~ ≤ AC 253 V; P~ ≤ 1500 VA, cos φ = 1, P~ ≤ 750 VA, cos φ > 0.7
- I⎓ ≤ 6 A (Ex de 4 A) to DC 30 V , I⎓ ≤ 0.2 A to 125 V
- When connecting a low-voltage circuit with double insulation according to IEC 1010, the following applies: the sum of the voltages of the relay output and power supply is ≤ 300 V
- The electronic insert FEL52 DC-PNP is preferred for low DC load currents (e.g. when connecting to a PLC)
- Relay contact material: silver/nickel AgNi 90/10

Electronic insert FEL55 (8/16 mA)

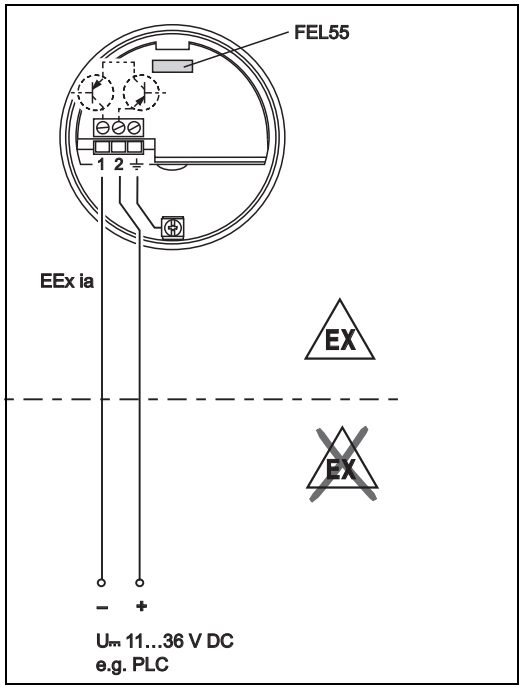
Power supply

Supply voltage: DC 11 to 36 V
Power consumption: < 600 mW
Reverse polarity protection
Overvoltage protection FEL55: overvoltage category III

Electrical connection

Two-wire connection for separate switching unit

For separate switching unit.
Signal transmission 16/8 mA on two-wire cabling.
For connection to programmable logic controllers (PLCs) for example,
AI module 4 to 20 mA to EN 61131-2.
Output signal jump from high to low current on point level.



L00-FTL5xxxx-04-05-xx-en-000

Output signal

~ 16 mA = 16 mA ± 5 %

~ 8 mA = 8 mA ± 6 %

☼ = lit

● = unlit

L00-FTL2xxxx-07-05-xx-xx-000

Safety mode	Level	Output signal	LEDs green	LEDs red
Max.		+ 2 ~16 mA 1	☼	●
		+ 2 ~8 mA 1	☼	☼
Min.		+ 2 ~16 mA 1	☼	●
		+ 2 ~8 mA 1	☼	☼

L00-FTL5xxxx-04-05-xx-xx-006

Signal on alarm

Output signal on power failure or in the event of damaged sensor: < 3.6 mA

Connectable load

- R = (U - 11 V) : 16.8 mA
- U = connection voltage: DC 11 to 36 V

Example: PLC with 250 Ω with 2-wire version

250 Ω = (U – 11V) / 16.8 mA
4.2 [Ω /A] = U – 11 V
U = 15.2 V

Electronic insert FEL56 (NAMUR L-H edge)

Power supply

Power consumption: < 6 mW at I < 1 mA; < 38 mW at I = 2.8 mA
Connection data interface: IEC 60947-5-6

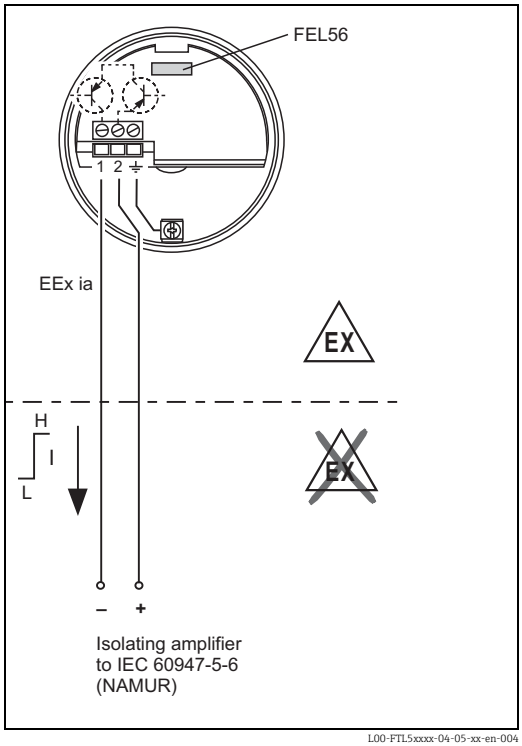
Electrical connection

Two-wire connection for separate switching unit

For connecting to isolating amplifiers acc. to NAMUR (IEC 60947-5-6), e.g. FTL325N, FTL375N from Endress+Hauser.
Output signal jump from low to high current on point level.

(L–H edge)

Connecting to multiplexer:
Set clock time to min. 2 s.



L00-FTL5xxxx-04-05-xx-en-004

Output signal

= lit
= flashes
= unlit

L00-FTL5xxxx-07-05-xx-xx-002

Safety mode	Level	Output signal	LEDs green	LEDs red
Max.		+ 2 → 1 : 0.6 … 1.0 mA	◔	●
		+ 2 → 1 : 2.2 … 2.8 mA	◔	☼
Min.		+ 2 → 1 : 0.6 … 1.0 mA	◔	●
		+ 2 → 1 : 2.2 … 2.8 mA	◔	☼

L00-FTL5xxxx-04-05-xx-xx-003

Signal on alarm

Output signal in the event of damaged sensor: > 2.2 mA

Connectable load

- See Technical Data of the isolating amplifier connected according to IEC 60947–5–6 (NAMUR)

Electronic insert FEL58 (NAMUR H-L edge)

Power supply

Power consumption: < 6 mW at I < 1 mA; < 38 mW at I = 3.5 mA
Connection data interface: IEC 60947-5-6

Electrical connection

Two-wire connection for separate switching unit

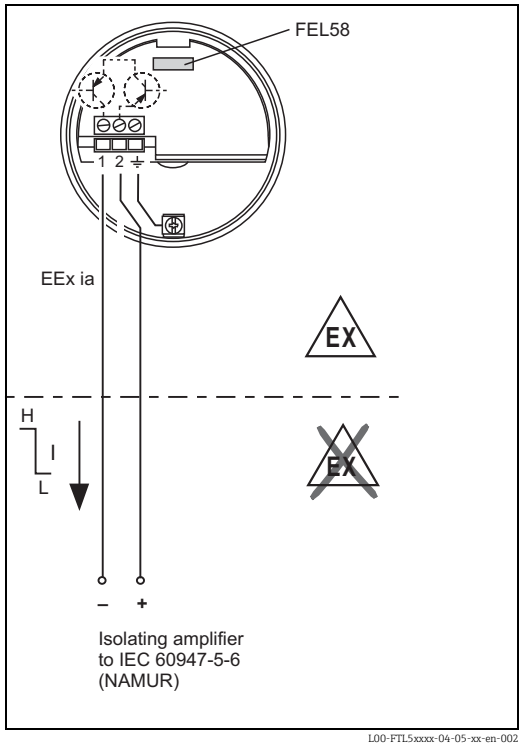
For connecting to isolating amplifiers as per NAMUR (IEC 60947-5-6), e.g. FTL325N, FTL375N from Endress+Hauser.
Output signal jump from high to low current on point level.

(H–L edge)

Additional function:
Test key on the electronic insert.
Pressing the key breaks the connection to the isolating amplifier.

✎ Note!
In Ex–d applications, the additional function can only be used if the housing is not exposed to an explosive atmosphere.

Connecting to multiplexer:
Set clock time to min. 2 s.



L00-FTL5xxxx-04-05-xx-en-002

Output signal

☼ = lit
☼ = flashes
● = unlit

L00-FTL5xxxx-07-05-xx-xx-002

Safety mode	Level	Output signal	LEDs green	LEDs yellow
Max.		+ 2 → 1 2.2 … 3.5 mA	☼	☼
		+ 2 → 1 0.6 … 1.0 mA	☼	●
Min.		+ 2 → 1 2.2 … 3.5 mA	☼	☼
		+ 2 → 1 0.6 … 1.0 mA	☼	●

L00-FTL5xxxx-04-05-xx-xx-007

Signal on alarm

Output signal in the event of damaged sensor: < 1.0 mA

Connectable load

- See Technical Data of the isolating amplifier connected according to IEC 60947–5–6 (NAMUR)
- Connection also to isolating amplifiers which have special safety circuits (I > 3.0 mA)

Electronics FEL58 (NAMUR H-L edge, in compact housing)

Power supply

Power consumption: < 6 mW at I < 1 mA; < 38 mW at I = 3.5 mA
Connection data interface: IEC 60947-5-6

Electrical connection

Two-wire connection for separate switching unit

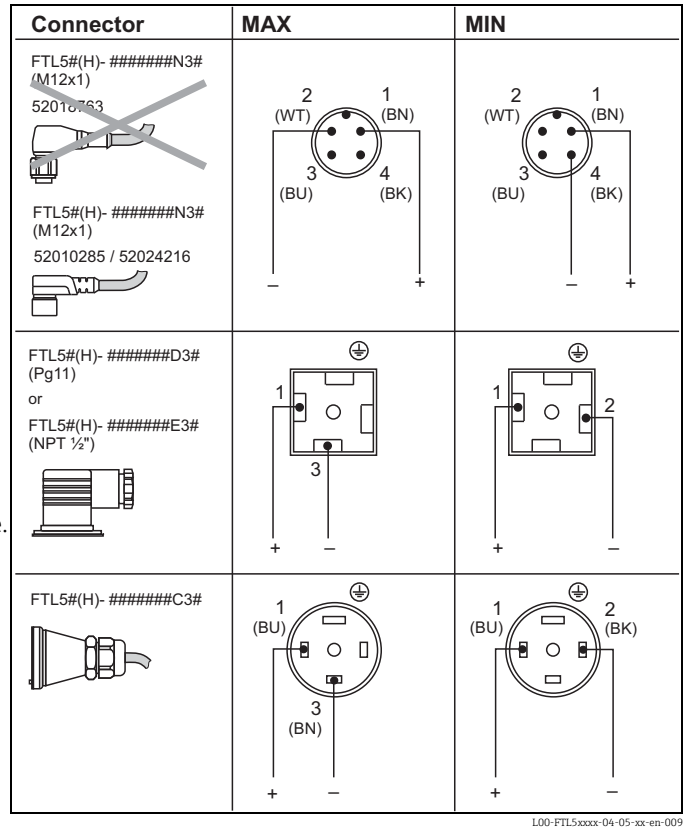
For connecting to isolating amplifiers acc. to NAMUR (IEC 60947-5-6), e.g. FTL325N, FTL375N from Endress+Hauser. Output signal jump from high to low current on point level.

(H–L edge)

Additional function:
If the test magnet is held against the marking on the nameplate, the output signal is inverted.

Connecting to multiplexer:
Set clock time to min. 3 s.

The NAMUR interface has a defined power consumption rate. Thus, it is not possible to use the M12 connector with an integrated LED (52018763).



L00-FTL5xxxx-04-05-xx-en-009

Output signal

= lit
= flashes
= unlit

L00-FTL5xxxx-07-05-xx-xx-002

Safety mode	Level	Output signal	LEDs green	LEDs yellow
Max.		+ 1 → 2.2… 3.5 mA → – 3	☼	☼
		+ 1 → 0.6… 1.0 mA → – 3	◪	●
Min.		+ 1 → 2.2… 3.5 mA → – 2	☼	☼
		+ 1 → 0.6… 1.0 mA → – 2	◪	●

L00-FTL5xxxx-04-05-xx-xx-007a

Signal on alarm

Output signal in the event of damaged sensor: < 1.0 mA

Connectable load

- See Technical Data of the isolating amplifier connected according to IEC 60947–5–6 (NAMUR)
- Connection also to isolating amplifiers which have special safety circuits (I > 3.0 mA)

Electronic insert FEL57 (PFM)

Power supply

Supply voltage: DC 9.5 to 12.5 V
Current consumption: 10 to 13 mA
Power consumption: < 150 mW
Reverse polarity protection

Electrical connection

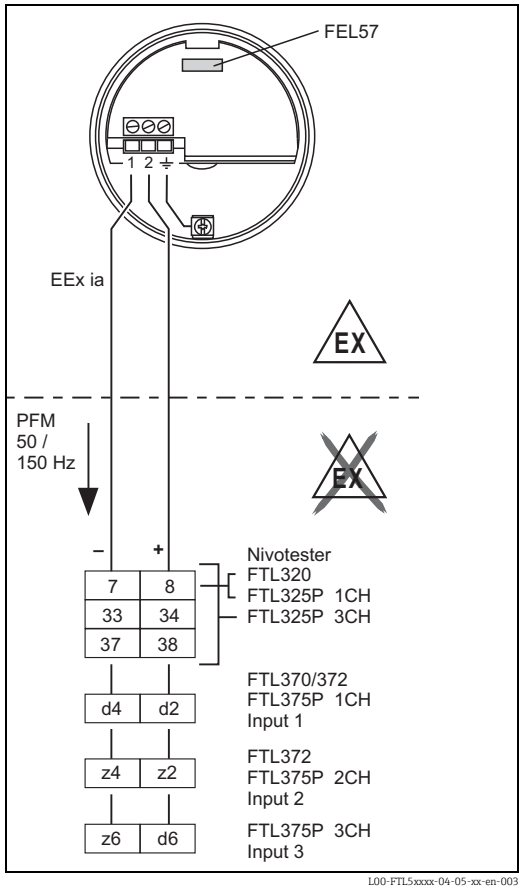
Two-wire connection for separate switching unit

For connecting to Endress+Hauser switching units Nivotester FTL320, FTL325P, FTL370, FTL372, FTL375P (also with proof test).

Output signal jump of the PFM signal from high to low frequency when sensor is covered. Switching between minimum/maximum safety in the Nivotester.

Additional function “proof test”:
After interruption of the power supply, a test cycle is activated which checks the sensor and electronics without any change in level.
Approved for overfill protection acc. to WHG (German Water Resources Act).
The following can be switched at the electronic insert:

- **Standard (STD):**
  Corrosion of the fork unlikely;
  simulation approx. 8 s
  tuning fork exposed – covered – exposed.
  For proof testing, the Nivotester tests the sensor's level notification function.
- **Extended (EXT)**:
  Corrosion of the fork possible;
  Simulation approx. 41 s: tuning fork exposed – covered – corroded – exposed.
  For proof testing, the Nivotester tests the sensor's level notification function and fault notification (alarm) function.

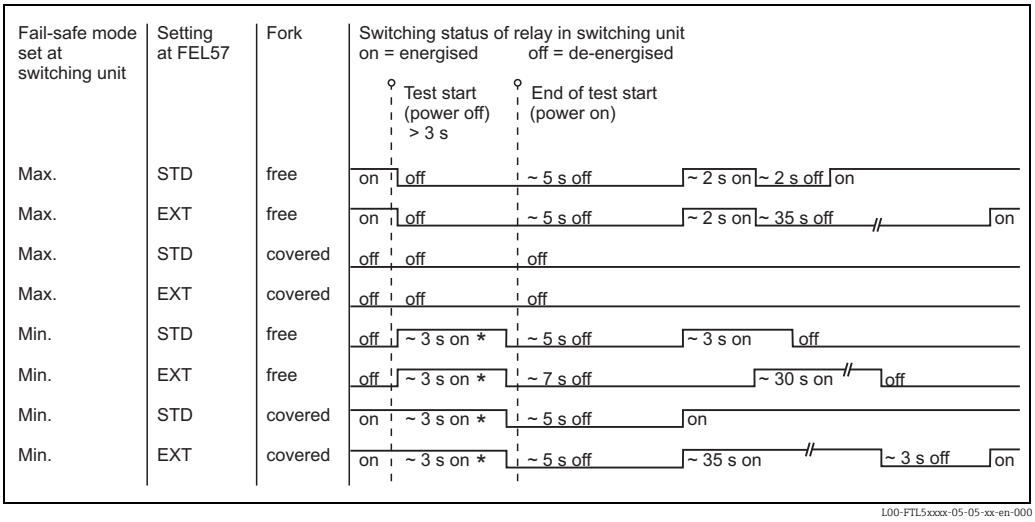


The check is activated and monitored at the switching unit.

The twin-core connecting cable (instrument cable) with a cable resistance of ≤ 25 Ω per core is connected to the screw terminals (conductor cross-sections 0.5 to 2.5 mm / 0.02 to 0.1 in) in the connection compartment. Protective circuits against reverse polarity, HF influences and overvoltage peaks are installed.
Maximum cable length up to 1000 m (3281 ft).

A shielded connecting cable is recommended in the event of strong electromagnetic interference. Here the shielding must be connected to the sensor and the power supply.

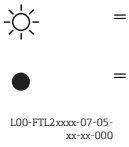
Switching behavior of the connected device:

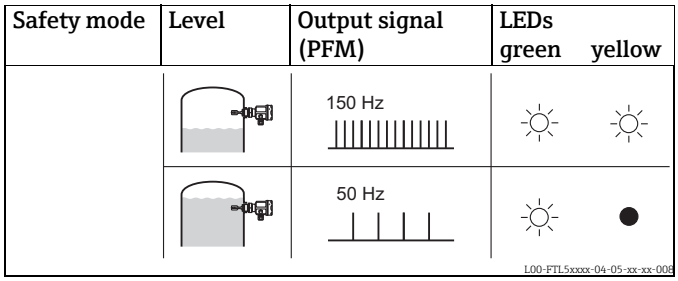

Fail-safe mode set at switching unit
Setting at FEL57
Fork
Switching status of relay in switching unit
on = energised off = de-energised
Test start (power off) > 3 s
End of test start (power on)
Max. STD free on off ~ 5 s off ~ 2 s on ~ 2 s off on
Max. EXT free on off ~ 5 s off ~ 2 s on ~ 35 s off on
Max. STD covered off off off
Max. EXT covered off off off
Min. STD free off ~ 3 s on * ~ 5 s off ~ 3 s on off
Min. EXT free off ~ 3 s on * ~ 7 s off ~ 30 s on off
Min. STD covered on ~ 3 s on * ~ 5 s off on
Min. EXT covered on ~ 3 s on * ~ 5 s off ~ 35 s on ~ 3 s off on
L00-FTL5xxxx-05-05-xx-en-000

* De-energized on power supply failure

Please note this switching response and function of the plant especially when replacing a Liquiphant incorporating electronic insert EL17Z or FEL37 with a Liquiphant M incorporating electronic insert FEL57.

Output signal





Signal on alarm

Output signal on power failure or in the event of damaged sensor: 0 Hz

Connectable load

- Floating relay contacts in the connected switching unit Nivotester FTL320, FTL325P, FTL370, FTL372, FTL375P
- For contact load, see the Technical Data of the switching unit.

Electronic insert FEL50A (PROFIBUS PA)

Power supply

Bus voltage: DC 9 to 32 V
Bus current:
- 12.5 mA +/– 1.0 mA (software version: 01.03.00, hardware version: 02.00)
- 10.5 mA +/– 1.0 mA (software version: 01.03.00, hardware version: 01.00)

Electrical connection

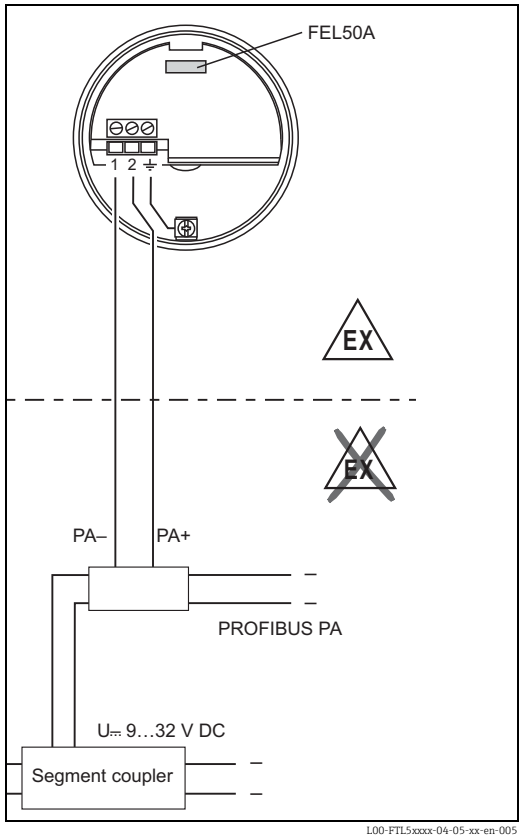
Two-wire connection for power supply and data transfer

For connecting to PROFIBUS PA

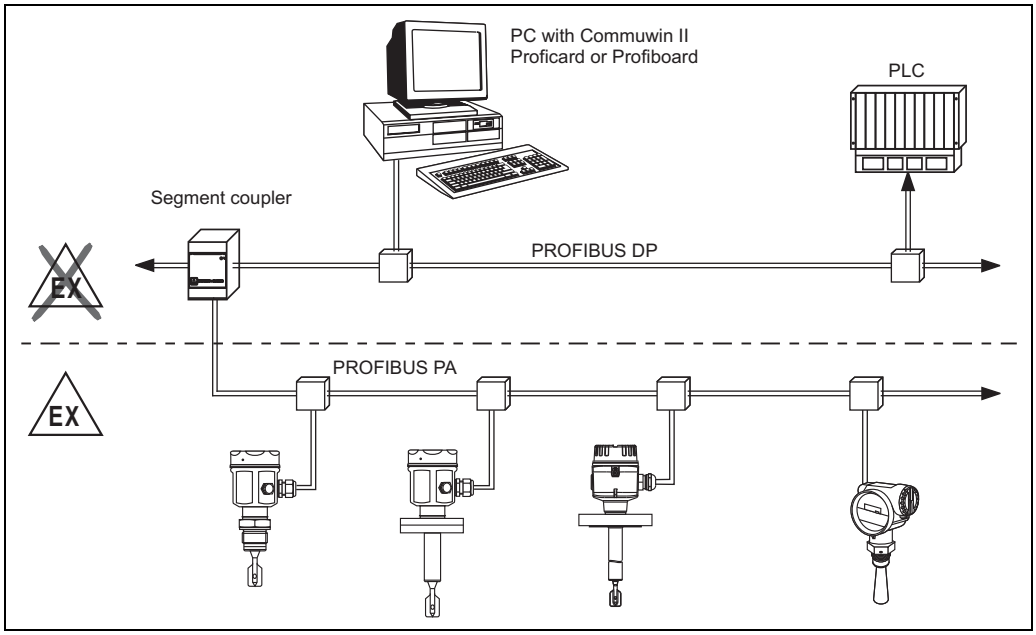
Additional functions:

– Digital communication enables the representation, reading and editing of the following parameters: Fork frequency, switch-on frequency, switch-off frequency, switch-on time and switch-off time, status, measured value, density switch.

– Matrix locking possible
– Switch to WHG mode possible (WHG approval)
– For a detailed description, see BA198F



L00-FTL5xxxx-04-05-xx-en-005



L00-FTL5xxxx-04-05-xx-en-006

Output signal

☼ = lit

● = unlit

L00-FTL2xxxx-07-05-xx-xx-000

Setting	Level	LEDs green	LEDs yellow	FEL50A
not inverted		☼	●	OUT_D = 0 PA bus signal
		☼	☼	OUT_D = 1 PA bus signal
inverted		☼	☼	OUT_D = 0 PA bus signal
		☼	●	OUT_D = 1 PA bus signal

L00-FTL5xxxx-04-05-xx-xx-009

Signal on alarm

- Failure information can be opened using the following interfaces:
  Yellow LED flashing, status code, diagnostic code; see BA00198F

Electronic insert FEL50D (density)

Power supply

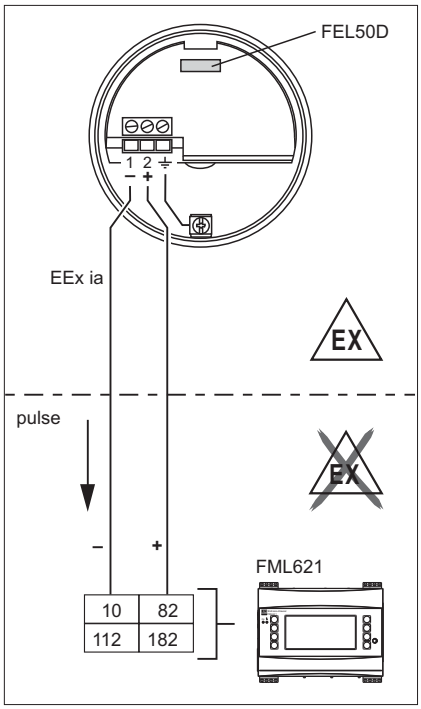
Frequency range: 300 to 1500 Hz
Signal level: 4 mA
Pulse height: 16 mA
Pulse width: 20 µS

Electrical connection

Two-wire connection at Density Computer FML621
For connecting to the density and concentration computer
FML621.

The output signal is based on pulse technology. With the aid of this signal, the fork frequency is constantly
forwarded to the switching unit.

Caution!
Operation with other switching units, such as FTL325P, is not permitted.
This electronic insert cannot be installed in devices that were originally used as a point level switch.



TI420Fen004

Signal on alarm

Output signal on power failure or in the event of damaged sensor: 0 Hz

Adjustment

In the Liquiphant M modular system, the option of an adjustment is also provided in addition to the electronics (see feature 60: "Accessories").

There are three types of adjustment:

Standard adjustment (see ordering information for additional option, basic version A)
- Here, two fork parameters are determined to describe the sensor characteristics, indicated in the adjustment report and provided with the product.
  These parameters must be transmitted to the Density Computer FML621.

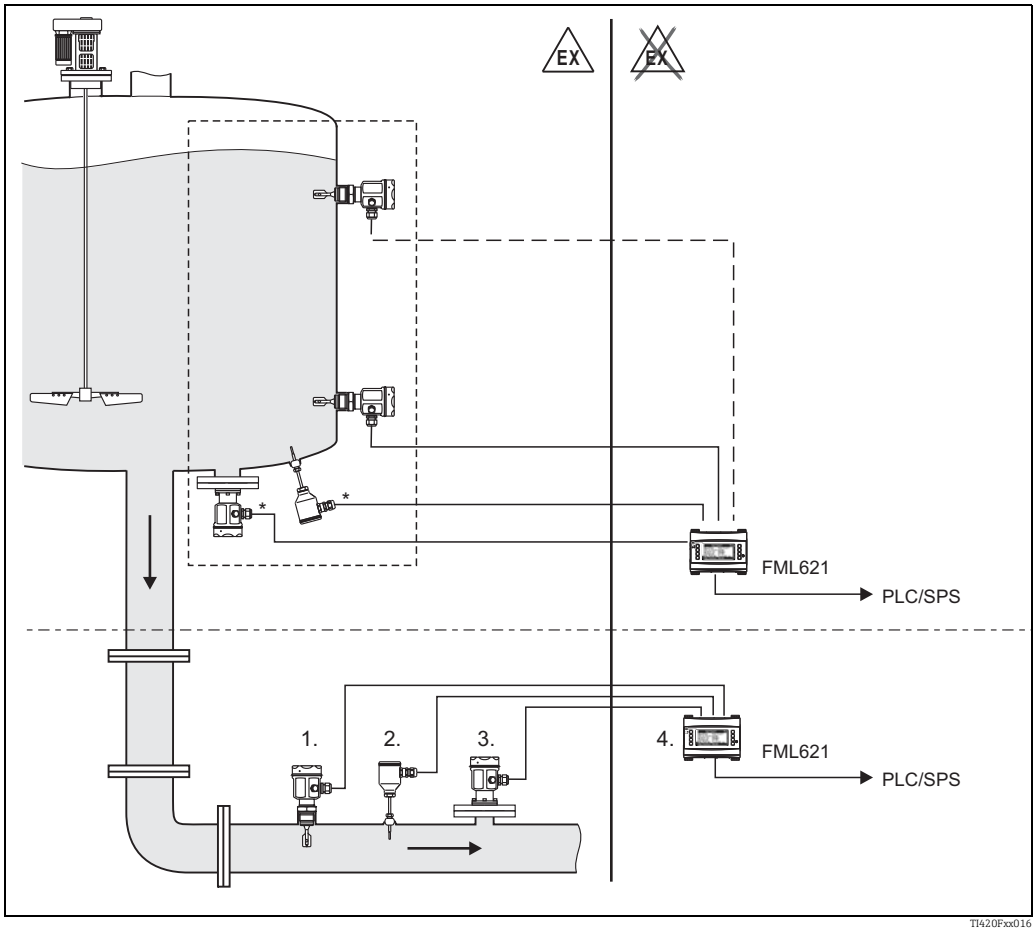
Special adjustment (see ordering information for additional option, special adjustment, density H_2O (K) or special adjustment, density H_2O with 3.1 certificate (L))
- Here, three fork parameters are determined to describe the sensor characteristics, indicated in the adjustment report and provided with the product.
  These parameters must be transmitted to the Density Computer FML621.
  Greater accuracy is achieved with this type of adjustment (see also "Performance characteristics").

Field Adjustment
- During field adjustment, a density value actually determined by the customer is entered and the system is automatically adjusted to this value (wet adjustment).

Note!
More information on Liquiphant M Density is available in Technical Information TI00420F. This can be downloaded from www.endress.com => Download.

Operating principle

Measuring the density of a liquid medium in pipes and tanks. Also suitable for use in hazardous areas, and preferably for applications in the chemical and food industry.



** Pressure and temperature information required depending on the application.*
1. Liquiphant M sensor with electronic insert FEL50D (pulse output);
2. Temperature sensor (e.g. 4 to 20 mA output);
3. Pressure transmitter (4 to 20 mA output);
4. Liquiphant density and concentration computer FML621 with display and operating unit

Light signals

LED	Symbol	Information
Yellow		Measurement valid
		Unstable process situation
		Maintenance required
Green		Power on
		Power off
Red		No fault
		Maintenance required
		Device failure

Connection and function

Connecting cables

- Electronic inserts: cross-section ≤ 2.5 mm² (14 AWG); strand in ferrule as per DIN 46228
- Protective ground in housing: cross-section ≤ 2.5 mm² (14 AWG)
- External equipotential bonding connection on housing: cross-section ≤ 4 mm² (12 AWG)

Safety mode

Minimum/maximum residual current safety selectable on electronic insert.
(with FEL57 on Nivotester only)

MAX = maximum safety:
The output switches to the power fail response when the fork is covered
For use with overfill protection for example

MIN = minimum safety:
The output switches to the power fail response when the fork is exposed
For use with dry running protection for example

Switching time

When fork is covered: approx. 0.5 s
When fork is exposed: approx. 1.0 s
Additionally configurable for PROFIBUS PA:
0.5-60 s

Other switching times available on request.

Switch-on behavior

When switching on the power supply, the output assumes the alarm signal.
After ≤ 3 s it assumes the correct switching mode (exception: FEL57)

Performance characteristics

Reference operating conditions

Ambient temperature: 23 °C (73 °F)

Medium temperature: 23 °C (73 °F)

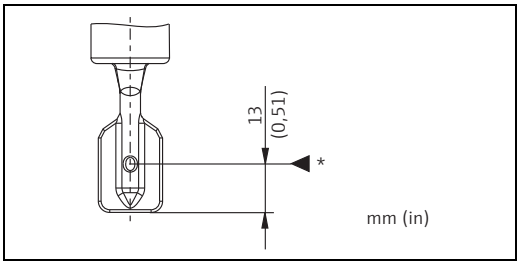
Medium density (water): 1 g/cm³ (SGU)

Medium viscosity: 1 mm²/s (cSt)

Medium pressure p_e: 0 bar (0 psi)

Sensor mounting: vertical from above

Density switch: to > 0.7 g/cm³ (SGU)



L00-FTL5xxxx-06-05-xx-xx-031

** Switch point under reference operating conditions*

Maximum measured error

Under reference operating conditions: max. +/−1 mm (0.04 in)

Repeatability

0.1 mm (0.004 in)

Hysteresis

approx. 2 mm (0.08 in)

Influence of medium temperature

max. +1.8 to −2.8 mm (−50 to +150 °C / -58 to 302 °F)

Influence of medium density

max. +4.8 to −3.5 mm ((0.5 to 1.5 g/cm³ (SGU))
max. +0.19 to -0.14 in

Influence of medium pressure

max. 0 to −2.5 mm (−1 to 64 bar (-14.5 to 928 psi))
max. 0 to -0.1 in

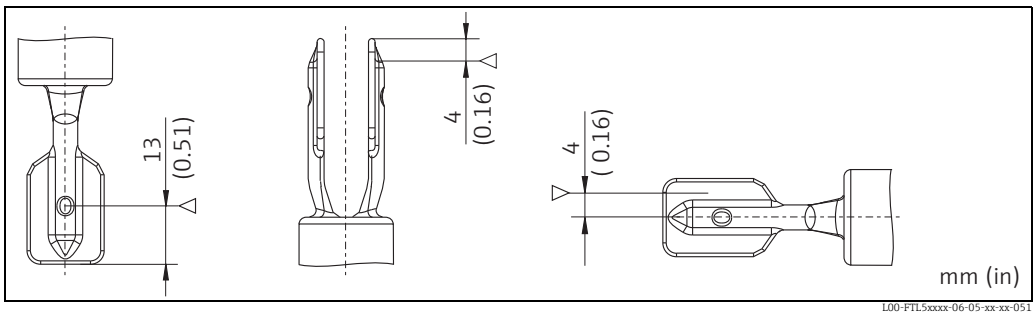
Operating conditions

Installation

Installation instructions

Switch points on the sensor depend on the mounting position, with reference to water,

Density 1 g/cm³ (SGU), 23 °C (73 °F), p_e 0 bar (0 psi).



Mounting from above *Mounting from below* *Mounting from the side*

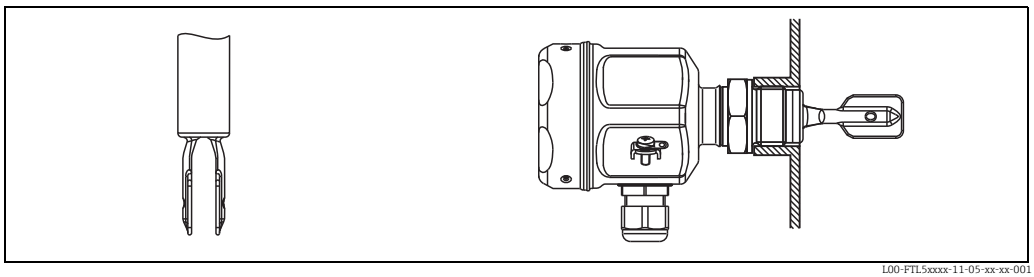
Note!
The switch points of the Liquiphant **M** are at other positions to those of the previous version Liquiphant **II**.

Examples of mounting

Examples of mounting with regard to the viscosity ν of the liquid and the tendency to form buildup

Optimum mounting, without problem even with high viscosity:

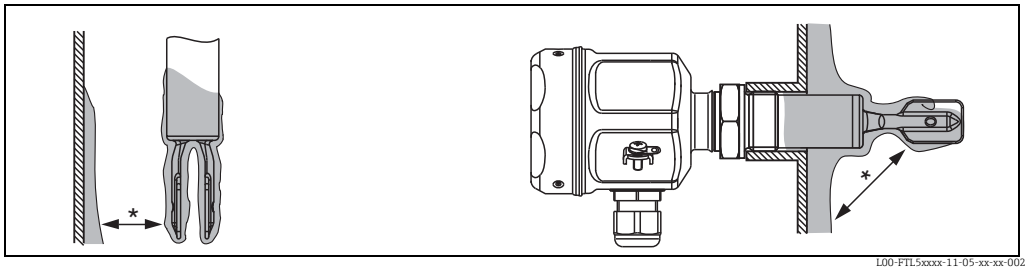
Position the fork so that the narrow edge of the tines is vertical to ensure that the liquid can run off easily.



Vertical from above *Flush-mounted from the side*

With buildup on the tank walls:

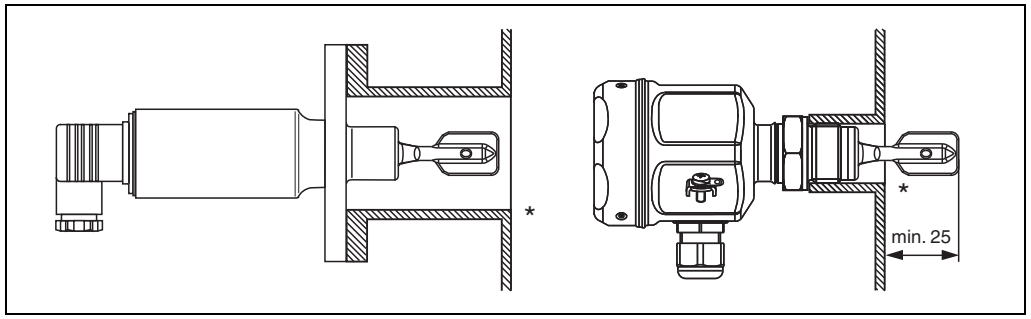
* Ensure that there is sufficient distance between the buildup expected on the tank wall and the fork.



Vertical from above *Protruding into the tank from the side*

Mounting positions in the case of low viscosity up to 2000 mm²/s (cSt):

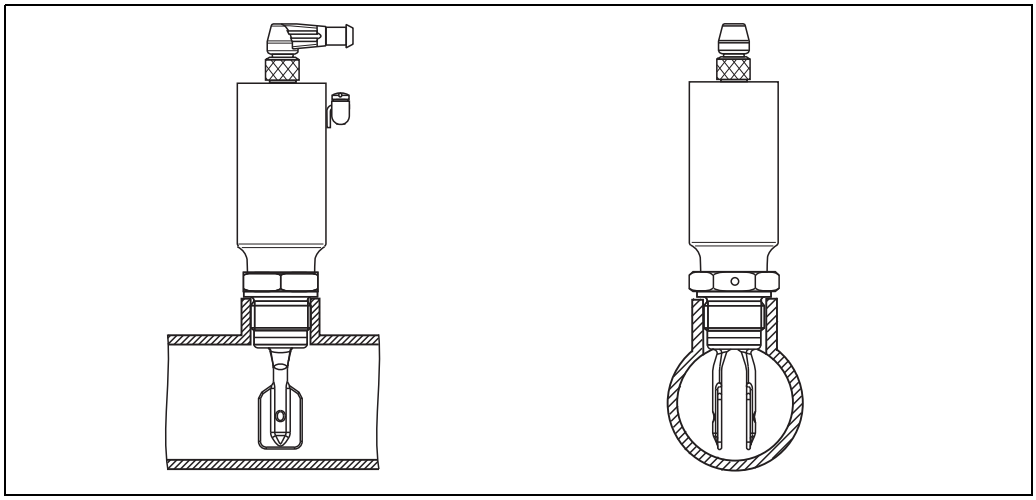
* Deburr the nozzle surfaces



L00-FTL5xxxx-11-05-xx-en-003

Mounting in piping from 2"

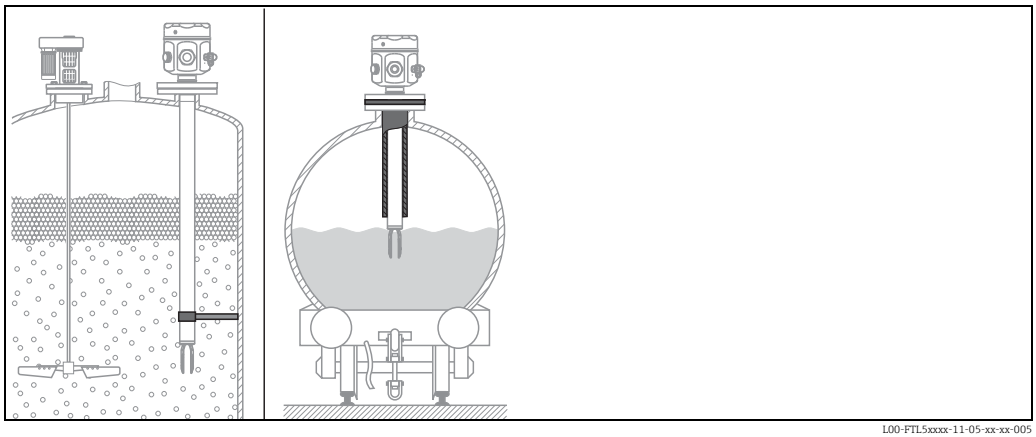
Flow velocities up to 5 m/s for viscosity of 1 mm²/s (cSt) and density 1 g/cm³ (SGU).
(Check the function for other medium conditions.)



L00-FTL5xxxx-11-05-xx-xx-004

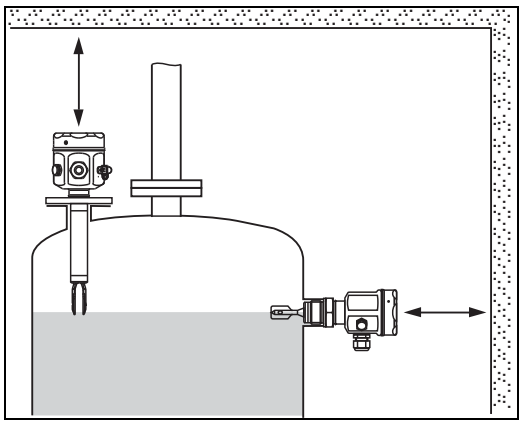
Dynamic load

Support the Liquiphant M FTL51(H) in the event of a severe dynamic load.



L00-FTL5xxxx-11-05-xx-xx-005

Ensure adequate space outside the tank for mounting, connection and configuration.



L00-FTL5xxxx-11-05-xx-xx-006

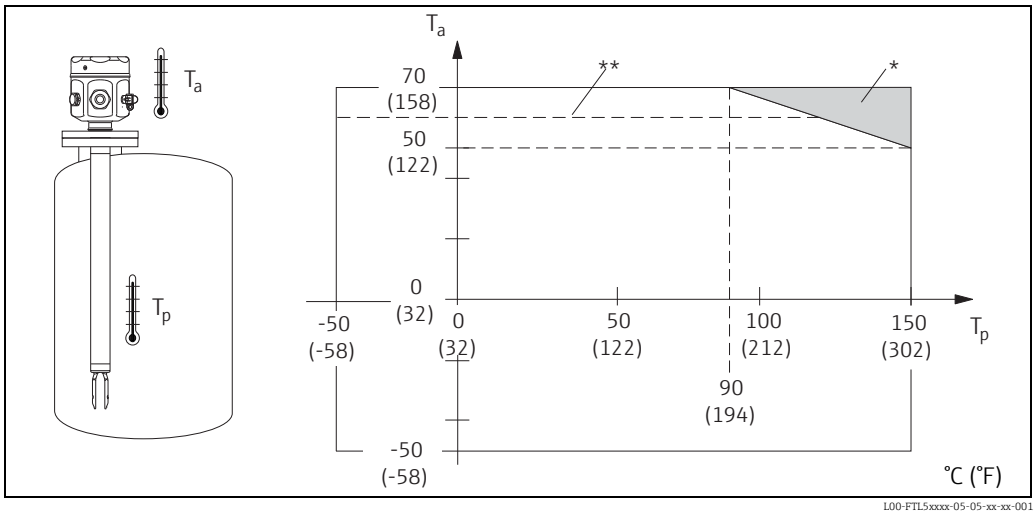
Orientation

- FTL50(H) and FTL51(H) with short pipe up to approx. 500 mm (19.7 in): any position
- FTL51(H) with long pipe: vertical

Environment

Ambient temperature range

Permitted ambient temperature T_a at the housing depending on the medium temperature T_p in the tank:



L00-FTL5xxxx-05-05-xx-xx-001

* Additional temperature range for devices with a temperature spacer or pressure-tight feedthrough.
** Maximum ambient temperature with FEL50D/FEL50A in hazardous areas.

Storage temperature

−50 to +80 °C (-58 to 176 °F)

Installation height as per IEC61010-1 Ed.3

Up to 2000 m (6600 ft) above sea level.

Can be extended up to 3000 m (9800 ft) above sea level if overvoltage protection is used, for example HAW562 or HAW569.

Climate class

Climate protection to IEC 68, Part 2-38, Fig. 2a

Degree of protection

Types of housing	IP65	IP66*	IP67*	IP68*	IP69k	NEMA type**
Compact housing with valve connector Pg11/NPT ½	X	–	–	–	–	–
Compact housing with 5 m (16 ft) cable tail	–	X	–	X	–	–
Compact housing with M12x1 connector (52010285) 316L (metal)	–	X	–	X	–	–
Compact housing with elbowed connector (52024216) / L= 5 m (16 ft), without integrated LEDs	–	X	–	X	X	–
Compact housing with elbowed connector (52018763) / L= 5 m (16 ft), with integrated LEDs	–	X	–	X	X	–
Polyester housing F16	–	X	X	–	–	4X
Stainless steel housing F15	–	X	X	–	–	4X
Aluminum housing F17	–	X	X	–	–	4X
Aluminum housing F13****	–	X	–	X***	–	4X/6P
Stainless steel housing F27	–	X	–	X	–	4X/6P
Aluminum housing T13 with separate connection compartment (Ex d)	–	X	–	X***	–	4X/6P

* As per EN60529
** As per NEMA 250
*** only with M20 cable entry or G1/2 thread
**** F13 housing only in conjunction with XP or Ex d approval

Vibration resistance

As per IEC 68, parts 2-6 (10 to 55 Hz, 0.15 mm (0.01 in), 100 cycles)
In the event of increased vibrations, the following additional option is recommended: feature "060" version "P" 100 bar (1450 psi) process pressure.

Electromagnetic compatibility

Interference emission to EN 61326, Electrical Equipment Class B
Interference immunity to EN 61326; Annex A (Industrial) and NAMUR Recommendation NE 21 (EMC)

Medium conditions

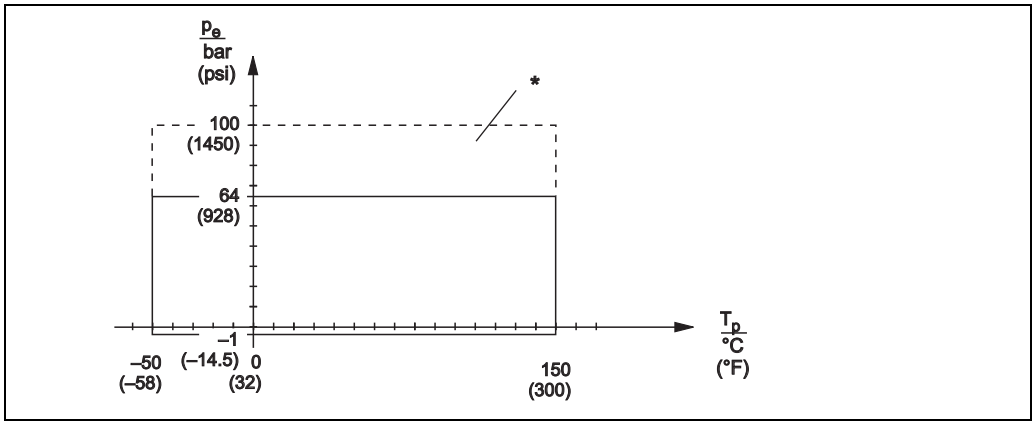
Medium temperature

−50 to +150 °C (-58 to 302 °F); for exceptions, see "Process connections"

Thermal shock

≤ 120 °C/s (248 °F/s)

Medium pressure p_e



L00-FTL5xxxx-05-05-xx-xx-003

* Permitted pressure rating when the "100 bar (1450 psi)" option is selected (see "Product structure FTL51", feature 060, from → 📄 43).
See "Process connections" → 📄 33 for exceptions.
Canadian CRN approval: Additional details on maximum pressure values are available in the download area of the product page at "www.endress.com".

Please refer to the standards listed for the permitted pressure values of the flanges at higher temperatures:

- pR EN 1092-1: 2005
  With regard to their stability-temperature property, the materials 1.4435 and 1.4404 are identical and are grouped together in EN 1092-1 Tab. 18 under 13E0. The chemical composition of the two materials can be identical.
- ASME B 16.5 - 2013 Tab. 2-2.2 F316
- ASME B 16.5 - 2013 Tab. 2-3.8 N10276
- JIS B 2220

The lowest value from the derating curves of the device and selected flange applies in each case.

Test pressure

p_e = 64 bar (928 psi):
- ≤ 100 bar (1450 psi) or 1.5 times the medium pressure p_e
- Sensor burst pressure at 200 bar (2900 psi)

p_e = 100 bar (1450 psi):
- ≤ 150 bar (2175 psi) or 1.5 times the medium pressure p_e)
- Sensor burst pressure at 400 bar (5800 psi)

Note!
The device function is restricted during pressure testing.

State of aggregation

Liquid

Density

0.7 g/cm³ (SGU) = delivery status

0.5 g/cm³* (SGU) can be adjusted via switches

* Density settings for the compact housing on request

Viscosity

≤ 10,000 mm²/s (cSt)

Solids content

≤ ø5 mm (0.2 in)

Lateral loading capacity

≤ 75 Nm

Mechanical construction

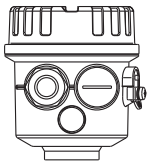
Design

Summary of all electrical and mechanical versions

Housing

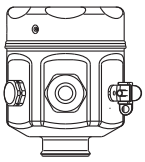
L00-FTL5xxxx-03-05-xx-xx-019

Compact
Pipe housing (316L)



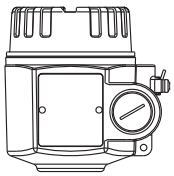
L00-FTL5xxxx-03-05-xx-xx-001

F16
Polyester (PBT)



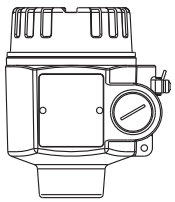
L00-FTL5xxxx-03-05-xx-xx-002

F15
Stainless steel (316L)



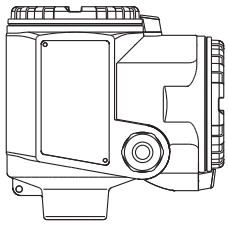
L00-FTL5xxxx-03-05-xx-xx-031

F17
Aluminum
Housing coated



L00-FTL5xxxx-03-05-xx-xx-033

F27
Stainless steel (316L)
F13
Aluminum
(also for Ex d/XP),
housing coated



L00-FTL5xxxx-03-05-xx-xx-004

T13
Aluminum with separate connection compartment (also Ex de and Ex d), housing coated

Plug-in electronic inserts to mount in the housing

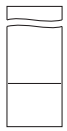
L00-FTL5xxxx-03-05-xx-xx-000

FEL51*:	Two-wire AC connection
FEL52*:	Three-wire DC connection PNP
FEL54:	Universal current connection, 2 relay outputs
FEL55:	Output 16/8 mA for separate switching unit
FEL56:	Output 0.6 to 1.0 / 2.2 to 2.8 mA for separate switching unit (NAMUR)
FEL58*:	Output 2.2 to 3.5 / 0.6 to 1.0 mA for separate switching unit (NAMUR)
FEL57:	Output 150/50 Hz, PFM, for separate switching unit (Nivotester)
FEL50A:	Digital communication PROFIBUS PA
FEL50D:	Pulse output for Density Computer FML621

* Electronics also available as compact housing. The electronics cannot be exchanged!

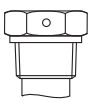
*Bushing*s (optional)

Temperature spacer and pressure-tight feedthrough



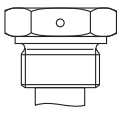
L00-FTL5xxxx-03-05-xx-xx-005

Process connections



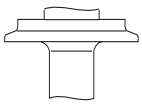
L00-FTL5xxxx-03-05-xx-xx-006

G ¾, DIN ISO 228/I
R ¾, EN10226
NPT ¾, ASME B 1.20.1
(AF 32)



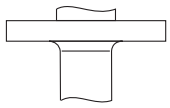
L00-FTL5xxxx-03-05-xx-xx-007

G 1, DIN ISO 228/I
R 1, EN10226
NPT 1, ASME B 1.20.1
(AF 41)



L00-FTL5xxxx-03-05-xx-xx-008

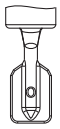
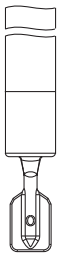
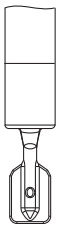
Diverse
hygienic and
aseptic
connections



L00-FTL5xxxx-03-05-xx-xx-009

Flanges as per DIN,
ASME,
JIS
from DN 25 / 1"

Sensors

Compact, with extension pipe up to 3 m (up to 6 m on request) or special "length L II" (see → 33ff.)	Compact	Length L II	Length L
			
p_e = bar/psi	64/928	64/928 100/1450	64/928 100/1450

L00-FTL5xxxx-03-05-xx-xx-018

Dimensions

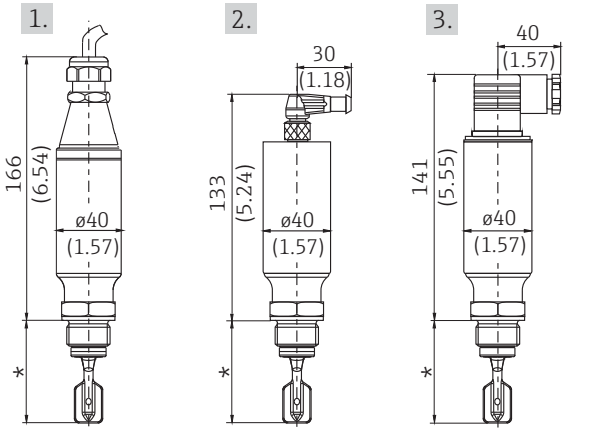
Dimensions in mm (in)!

Housing FTL50(H), FTL51(H) with sensor FTL50(H)

Compact housing, primarily for hygiene applications

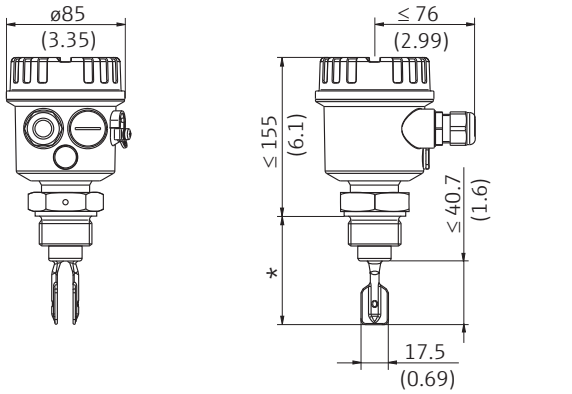
c

1. 5 m cable
2. M12 connector
3. Pg11/NPT ½ connector



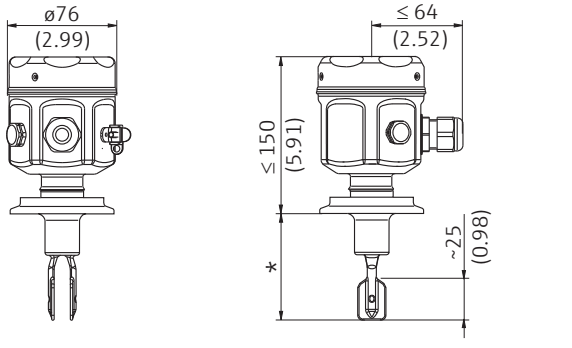
L00-FTL5xxxx-06-05-xx-xx-085

Polyester housing F16



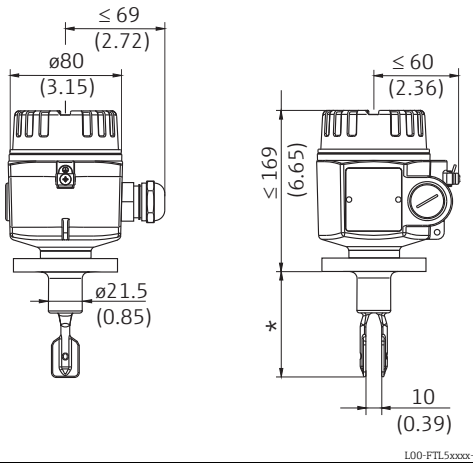
L00-FTL5xxxx-06-05-xx-xx-086

F15 stainless steel housing primarily for hygiene applications



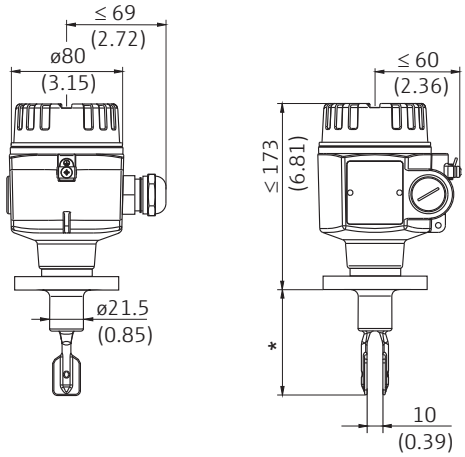
L00-FTL5xxxx-06-05-xx-xx-087

Aluminum housing F17



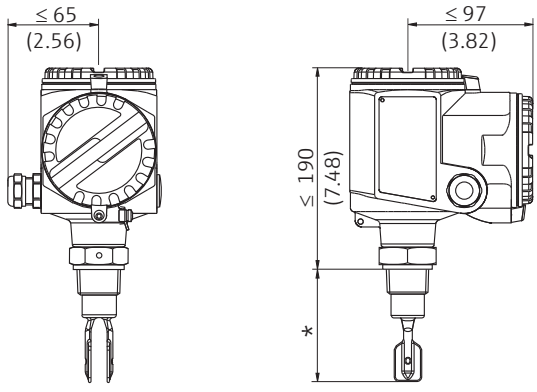
L00-FTL5xxxx-06-05-xx-xx-088

Stainless steel housing (316L) F27
Aluminum housing F13



L00-FTL5xxxx-06-05-xx-xx-089

Aluminum housing T13
with separate connection compartment



L00-FTL5xxxx-06-05-xx-xx-090

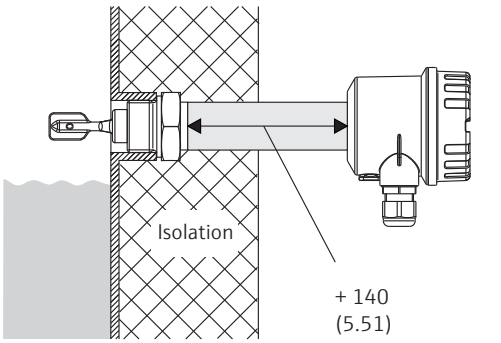
* See "Process connections"

Note!
The switch points of the Liquiphant **M** are at other positions to those of the previous version Liquiphant **II**.

Bushings: temperature spacer, pressure-tight feedthrough

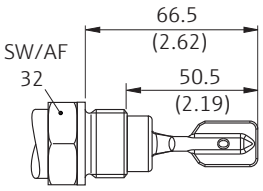
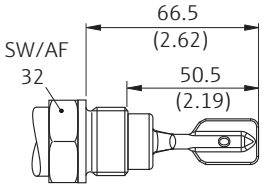
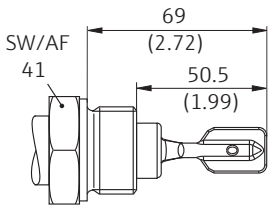
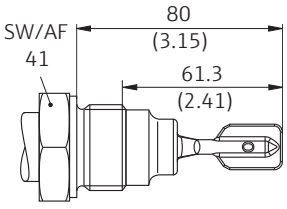
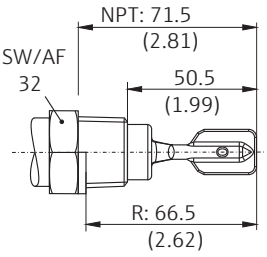
Temperature spacer
Provides sealed insulation for the vessel and normal ambient temperatures for the housing.

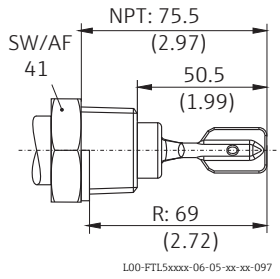
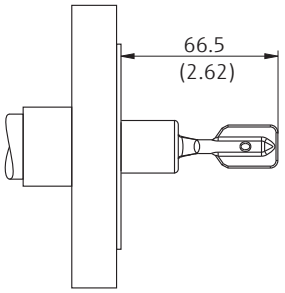
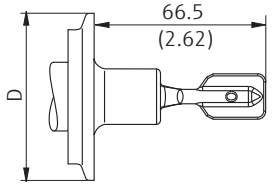
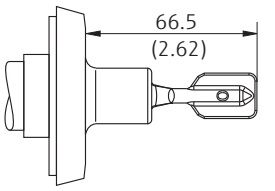
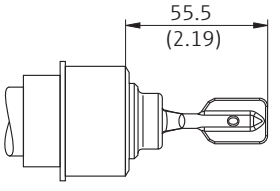
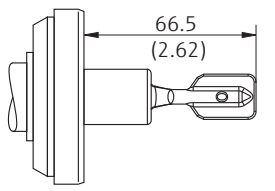
Pressure-tight feedthrough
Protects the housing from pressures up to 100 bar (1450 psi) if the sensor is damaged. Provides sealed insulation for the vessel and normal ambient temperatures for the housing.

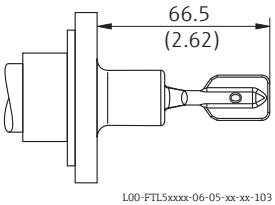
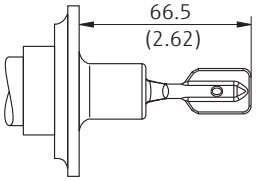
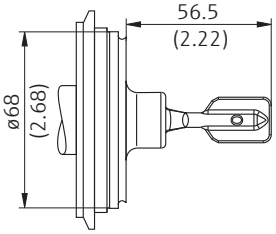
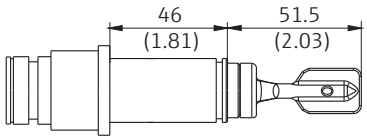


L00-FTL5xxxx-06-05-xx-xx-091

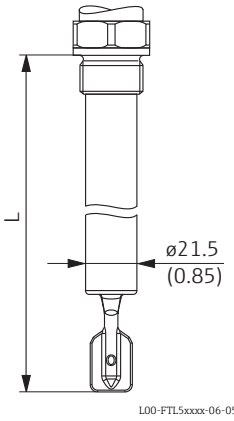
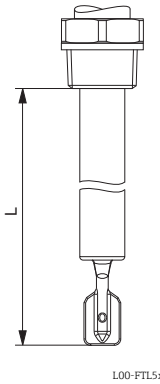
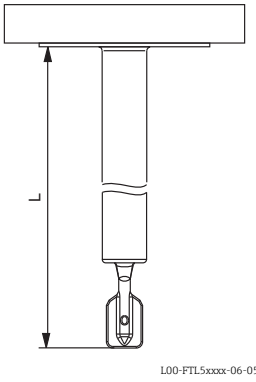
Process connections for FTL50(H) and FTL51(H)

Process connection		Dimensions	Accessories	Pressure Temperature
G ¾ DIN ISO 228/1 with defined thread start; Flat seal to DIN 7603: supplied	GQ2 GQ6	 L00-FTL5xxxx-06-05-xx-xx-092		≤ 100 bar / only FTL51 (≤ 1450 psi) ≤ 150 °C (302 °F)
G ¾ DIN ISO 228/1 with defined thread start for flush-mounted installation in weld-in adapter	GQ2 GQ6	 L00-FTL5xxxx-06-05-xx-xx-093	**Weld-in adapter** (with defined thread start) with silicone O-ring only FTL50, FTL50H See "Accessories" In conformity with FDA*	≤ 25 bar (363 psi) ≤ 150 °C (302 °F) ≤ 40 bar (580 psi) ≤ 100 °C (212 °F)
G 1 DIN ISO 228/1 Flat seal to DIN 7603: supplied	GR2 GR6	 L00-FTL5xxxx-06-05-xx-xx-094		≤ 100 bar / only FTL51 (1450 psi) ≤ 150 °C (302 °F)
G 1 DIN ISO 228/1 with defined thread start With seal surface for flush-mounted installation in weld-in adapter	GW2	 L00-FTL5xxxx-06-05-xx--095	**Weld-in adapter** (with defined thread start) with silicone O-ring See "Accessories" In conformity with FDA*	≤ 25 bar (363 psi) ≤ 150 °C (302 °F) ≤ 40 bar (580 psi) ≤ 100 °C (212 °F)
NPT ¾ ASME B 1.20.1 or **R ¾** DIN/EN 10226	GM2 GM6 GE2 GE6	 L00-FTL5xxxx-06-05-xx-xx-096		≤ 100 bar / only FTL51 (1450 psi) ≤ 150 °C (302 °F)

Process connection		Dimensions	Accessories	Pressure Temperature
NPT1 ASME B 1.20.1 or **R 1** DIN/EN 10226	GN2 GN6 GF2 GF6			≤ 100 bar / only FTL51 (1450 psi) ≤ 150 °C (302 °F)
* FDA-compliant material in accordance with 21 CFR Part 177.2600 (silicone)				
Flanges ASME B 16.5 EN 1092-1 (DIN 2527 B) JIS B2220	A## B## C## F## N## K##		Seal depending on design installed on site	See nominal pressure of flange, however ≤ 100 bar (1450 psi) (only FTL51) ≤ 150 °C (302 °F)
	For higher chemical-resistance, AlloyC22-plated flanges are available. The flange carrier material is made of 316L and is welded with a 2 to 3 mm (0.08 to 0.12 in) thick AlloyC22 disk.			
Tri-Clamp ISO 2852 DN25-38 (1 to 1 ½") DIN 32676 DN25-40 ø D = 50.5 mm (1.99 in) ISO 2852 DN40-51 (2") DIN 32676 DN50 ø D = 64.0 mm (2.52 in)	TC2 TE2		Clamping ring and front seal installed on site**	≤ 25 bar (363 psi) ≤ 150 °C (302 °F)
	Mounting with NA connector only in conjunction with T13, F13 and compact housing. Other housings on request.			
Threaded pipe joint DN 32 DN 40 DN 50 DIN 11851 with thread adapter nut	MA2 MC2 ME2		Sealing ring with collar, installed on site**	DN 32, DN 40: ≤ 40 bar (580 psi) up to 100 °C (212 °F) ≤ 25 bar (363 psi) up to 140 °C (284 °F) DN 50: ≤ 25 bar (363 psi) ≤ 140 °C (284 °F)
Flush-mounted for weld-in adapter Factory standard Endress+Hauser with silicone seal and thread adapter nut: supplied	EE2		**Weld-in adapter** (fork can be positioned) See "Accessories" In conformity with FDA*	≤ 40 bar (580 psi) ≤ 100 °C (212 °F) ≤ 25 bar (363 psi) ≤ 150 °C (302 °F)
Aseptic DN 50 DIN 11864-1 Form A for pipe DIN 11850 with thread adapter nut	HE2		sealing ring installed on site**	≤ 25 bar (363 psi) ≤ 140 °C (284 °F)

Process connection		Dimensions	Accessories	Pressure Temperature
DRD With clamped flange	PE2	 L00-FTL5xxxx-06-05-xx-xx-103	Welding flange with PTFE flat seal (fork can be positioned) See "Accessories" (or installed on site)** In conformity with FDA*	≤ 40 bar (580 psi) ≤ 100 °C (212 °F) ≤ 25 bar (363 psi) ≤ 150 °C (302 °F)
* FDA-compliant material in accordance with 21 CFR Part 177/2600 (silicone), 21 CFR Part 177.1550 (PTFE) ** The maximum temperature and the maximum pressure are dependent on the clamping ring used and the seal used. The lowest value applies in each case.				
SMS 2" (DN 51) with thread adapter nut	UE2	 L00-FTL5xxxx-06-05-xx-xx-104	sealing ring installed on site**	≤ 25 bar (363 psi) ≤ 140 °C (284 °F)
Varivent for piping ≥ DN 65 ≥ O.D. 3" ≥ I.P.S. 3"	WE2	 L00-FTL5xxxx-06-05-xx-xx-105	Clamping ring and O-ring seal, installed on site**	However, see specification as per Tuchenhagen VARIVENT-Inline housing: ≤ 25 bar (363 psi) ≤ 150 °C (302 °F)
Ingold fitting DN 25 Fitting length 46 mm (2.52 in) Thread adapter nut G 1 ¼ with O-ring seal, EPDM (FDA-compliant, USP Class VI*)	TT2	 L00-FTL5xxxx-06-05-xx-xx-106		≤ 16 bar (232 psi) ≤ 150 °C (302 °F)
* FDA-compliant material in accordance with 21 CFR Part 177/2600 (EPDM) ** The maximum temperature and the maximum pressure are dependent on the clamping ring used and the seal used. The lowest value applies in each case.				

Sensor length L for FTL51 and FTL51H, depending on process connection

Thread: G ¾ G 1	Thread: NPT ¾ NPT1 R ¾ R 1	Flanges and flange-like process connections
		
From seal surface of thread adapter	From lower edge of thread	

Customized length L:
- 148 mm to 3000 mm (6 to 115in); special version (TSP) on request up to 6000 mm (235 in)
- Length tolerances L: < 1 m (–5 mm), 1 to 3 m (–10 mm) / < 3.3 ft (-0.2 in), 3.3 to 9.8 ft (-0.39 in)

Note!
The switch points of the Liquiphant M are at other positions to those of the previous version Liquiphant **II**.
Special length "L II":
With vertical mounting from above the same switch point as for the Liquiphant II
FTL360, FTL365, FDL30, FDL35

"L II" depends on process connection:

L = 115 mm (4.53 in) for flanges and flange-like process connections
L = 99 mm (3.9 in) for threads NPT and R (BSPT)
L = 118 mm (4.65 in) for threads G1 (BSP 1)
L = 115 mm (4.53 in) for threads G ¾ (BSP ¾)
L = 104 mm (4.09 in) for flush-mounted 1" (Endress+Hauser)

Weights

See "Ordering information" → 🖹 43ff

Materials and surfaces

Material specifications as per AISI and DIN-EN.

Parts in contact with process

- Process connection and extension pipe:
  - FTL5x → 316L (1.4404 or 1.4435) optional 2.4602 (AlloyC22)
  - FTL5xH → 316L (1.4435)
- Tuning fork: 316L (1.4435) optional 2.4602 (AlloyC22)
- Flanges: 316L (1.4404)
- Flange plating: AlloyC22
- Flat seal for process connection G ¾ or G 1: elastomer fiber, asbestos-free

Surface roughness

Choice of mechanically polished surface roughness (version → probe length → type):

- Ra < 1.5 µm (59.1 µin), with EHEDG approval
- Ra < 0.3 µm (11.8 µin), 3-A and EHEDG approval and CoC-ASME-BPE

Note!
The surface is electropolished if the additional option "B"
(CoC - ASME BPE) is selected in addition to surface roughness quality Ra < 0.3 µm (11.8 µin). The

surface roughness is then: Ra < 0.38 µm (15.0 µin).
With this combination, the wetted parts are made of 316L (1.4435) in accordance with BN2 (delta-ferrite content < 1 %).

Parts with no process contact

- Tuning fork/housing seal: EPDM
- Temperature spacer: 316 L (1.4435)
- Pressure-tight feedthrough: 316L (1.4435)
- Ground terminal on housing (external): 316L (1.4404)
- Cable glands
  - Housing F13, F15, F16, F17: polyamide (PA)
    With B or C approval (→ 📄 43 ordering information): nickel-plated brass
  - Housing F27: polyamide PA, with approval "B" or "C" 316L (1.4435)
  - Housing T13: nickel-plated brass
- Polyester housing F16: PBT-FR with PBT-FR cover or with PA12 transparent cover
  - Cover seal: EPDM
  - Nameplate glued: polyester film (PET)
  - Pressure compensation filter: PBT-GF20
- Stainless steel housing F15: 316L (1.4404)
  - Cover seal: silicone
  - Safety claw: 304 (1.4301)
  - Pressure compensation filter: PBT-GF20, PA
- Aluminum housing F17/F13: EN-AC-AlSi10Mg, plastic-coated
  - Nameplate: aluminum, anodized
  - Cover seal: EPDM
  - Safety claw: nickel-plated brass
  - Pressure compensation filter: silicone
- Stainless steel housing F27: 316L
  - Nameplate: 316L (1.4404)
  - Cover seal: FVMQ (optional: EPDM seal available as spare part)
  - Safety claw: 316L (1.4435)
- Aluminum housing T13: EN-AC-AlSi10Mg, plastic-coated,
  - Nameplate: aluminum, anodized
  - Cover seal: EPDM
  - Safety claw: nickel-plated brass
- Compact housing (valve connector or M12 connector): 316L (1.4435)

Process connections

- Parallel thread G ¾, G 1 to DIN ISO 228/I with flat seal to DIN 7603
- Tapered thread R ¾, R 1 to EN10226
- Tapered thread ¾ -14 NPT, 1 - 11½ NPT as per ASME B 1.20.1
- Flush-mounted installation with weld-in adapter to factory standard Endress+Hauser (G ¾, G 1)
- Flush-mounted installation with weld-in adapter to factory standard Endress+Hauser (1"), sensor can be positioned
- Tri-Clamp 1½", 2" to ISO 2852
- Threaded pipe joint DN 32, 40, 50 to DIN 11851
- Aseptic connection DN 50 to DIN 11864-1
  Form A for pipe DIN 11850
- SMS connection 2" (DN 51)
- DRD flange
- Varivent® DN 50 (50/40) to factory standard Tuchenhagen
- Flanges: as per EN/DIN 1092-1 from DN 25, as per ASME B 16.5 from 1", as per JIS B2220 (RF)
- Ingold DN25 fitting length 46 mm (1.81 in) with thread adapter nut G1 ¼

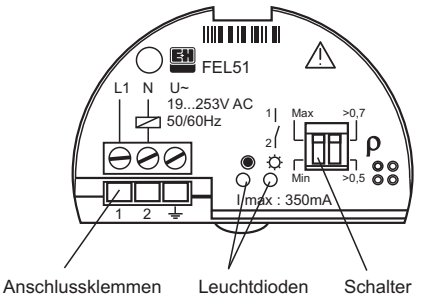
Further details at Ordering information → 📄 43.

Human interface

Electronic inserts

With FEL51, FEL52, FEL54, FEL55:

- 2 switches for safety mode and density change
- green LED to indicate operational status
- red LED to indicate the switching status, flashes in the event of corrosion damage on sensor or if the electronics are defective



L00-FTL5xxxx-03-05-xx-en-001

With FEL56:

- 2 switches for safety mode and density change
- green LED flashes to indicate operational status
- red LED to indicate the switching status, flashes in the event of corrosion damage on sensor or if the electronics are defective

With FEL57:

- 2 switches for density change and Testing
- green LED to indicate operational status
- yellow LED to indicate the covered status, flashes in the event of corrosion damage on sensor or if the electronics are defective

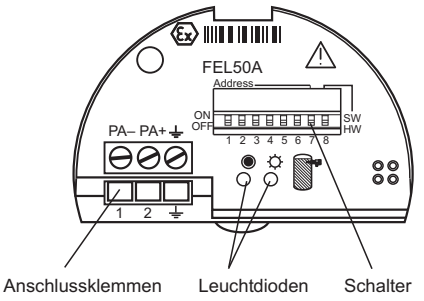
L00-FTL5xxxx-03-05-xx-xx-013

With FEL58:

- 2 switches for safety mode and density change
- green LED
  - flashes quickly to indicate operational status,
  - flashes slowly in the event of corrosion damage to the sensor of if the electronics are defective
- yellow LED to indicate the switching status, Test key – breaks the cable connection

With FEL50A:

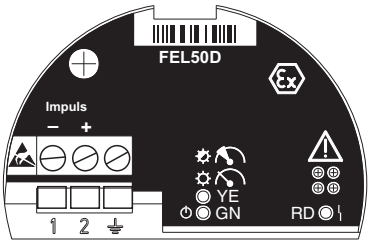
- 8 switches for configuring the device address
- green LED to indicate operational status, pulsing to indicate communication;
- yellow LED to indicate the switching status, flashes in the event of corrosion damage on sensor or if the electronics are defective



L00-FTL5xxxx-03-05-xx-en-002

With FEL50D:

- yellow LED: to indicate the validation of the measurement
- green LED: to indicate the operational status
- red LED: to indicate faults



TI328Fxx004

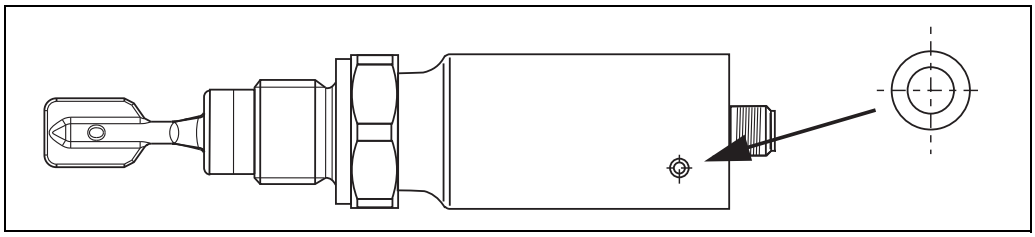
Compact housing

Function test with test magnet

Versions AC, DC-PNP and NAMUR:

During the test, the current state of the electronic switch is reversed.

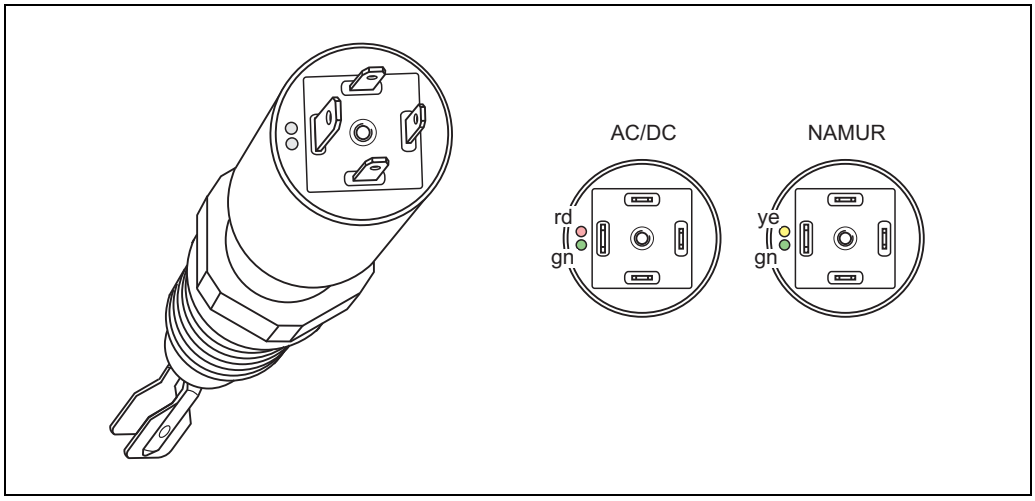
Hold the test magnet against the marking on the nameplate: The switching status is changed.



L00-FTL5xxxx-19-05-xx-xx-001

Light signals

Versions AC and DC-PNP with valve connector or cable tail



L00-FTL5xxxx-07-05-xx-xx-005

Green light (gn) lights up (AC/DC):

Liquiphant M is connected to the power supply and is operational.

Green light (gn) flashing (NAMUR):

Liquiphant M is connected to the power supply and is operational.

Red light (rd) lights up (AC/DC):

MAX application mode (overfill protection): sensor is immersed in liquid.
MIN application mode (dry running protection): sensor is not immersed in liquid.

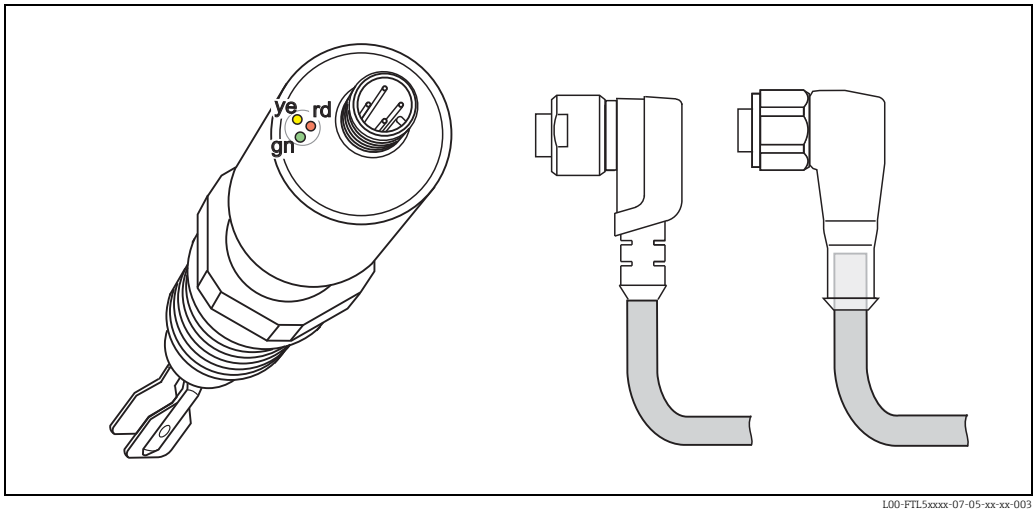
Yellow light (ye) lights up (NAMUR):

MAX application mode (overfill protection): sensor is not immersed in liquid.
MIN application mode (dry running protection): sensor is immersed in liquid.

Red light (rd) flashing (AC/DC):

Liquiphant M has detected a fault.

Version NAMUR and DC-PNP with M12x1 round connector 316L



L00-FTL5xxxx-07-05-xx-xx-003

Green light (gn) lights up (DC-PNP):

Liquiphant M is connected to the power supply and is operational.

Green light (gn) flashing with 1 Hz (NAMUR):

Liquiphant M is connected to the power supply and is operational.

Yellow light (ye) lights up (DC-PNP):

Sensor is immersed in liquid.

Yellow light (ye) lights up (NAMUR):

MAX application mode (overfill protection): sensor is not immersed in liquid.
MIN application mode (dry running protection): sensor is immersed in liquid.

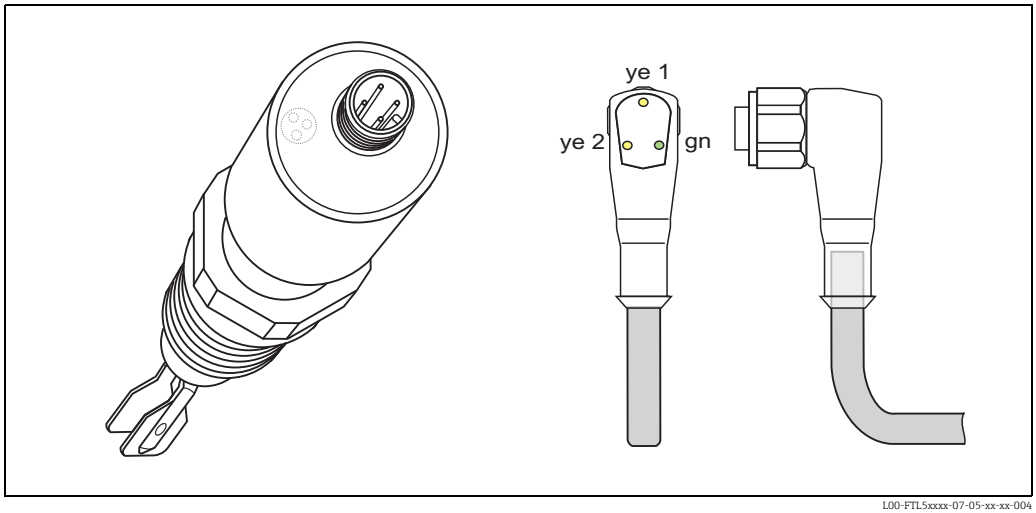
Red light (rd) flashing (DC-PNP):

Liquiphant M has detected a fault.

Green light (gn) flashing with 0.3 Hz (NAMUR):

Liquiphant M has detected a fault.

Version DC-PNP with M12x1 round connector 316L



L00-FTL5xxxx-07-05-xx-xx-004

Green light (gn) lights up:

Liquiphant M is connected to the power supply and is operational.

Yellow light (ye 1) lights up:

MAX application mode (overfill protection): sensor is not immersed in liquid.
MIN application mode (dry running protection): sensor is not immersed in liquid.

Yellow light (ye 2) lights up:

MAX application mode (overfill protection): sensor is immersed in liquid.
MIN application mode (dry running protection): sensor is immersed in liquid.

Green light (gn) lights up, both yellow lights (ye 1+2) do not light up:

Liquiphant M has detected a fault.

Operating concept

Onsite configuration

Certificates and approvals

CE mark

The measuring system meets the legal requirements of the applicable EC Directives. These are listed in the corresponding EC Declaration of Conformity along with the standards applied.
Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

C-tick mark

The measuring system complies with the EMC requirements of the "Australian Communications and Media Authority (ACMA)".

General approvals

The following approvals are available for Liquiphant M FTL50H, FTL51H:

- EHEDG: certification (from TNO, The Netherlands), Report No. V99.394:
- 3A: 3A certificate (USA), Authorization no. 459: 74-06 Sensors and Sensor Fittings and Connections
- Certificate of Compliance as per ASME BPE-2012. (Order code: additional option = B)

Process connections	Order code	EHEDG + 3A		ASME BPE + CoC	
				Ra (µm)	
				< 0.38	< 1.5
Thread ISO228 G3/4, 316L, installation Thread ISO228 G1, 316L, installation Accessories: weld-in adapter	GQ2 GW2	X	X	–	X
Tri-Clamp ISO2852 DN25-38 (1 to 1-1/2"), 316L Tri-Clamp ISO2852 DN40-51 (2"), 316L	TC2 TE2	X	X	X	X
DIN11851 DN32 PN25 slotted nut, 316L DIN11851 DN40 PN25 slotted nut, 316L DIN11851 DN50 PN25 slotted nut, 316L	MA2 MC2 ME2	X	X	X	X
Flush-mounted, 316L, installation Accessories, weld-in adapter	EE2	X	X	X	X
DIN11864-1 A DN50 pipe DIN11850, Slotted nut, 316L	HE2	X	X	X	X
DRD 65mm, 316L	PE2	X	–	–	X
SMS 2" PN25, 316L	UE2	X	X	X	X
Varivent N pipe DN65-162 PN10, 316L	WE2	X	X	X	X
Ingold fitting 25x46mm, 316L	TT2	–	–	X	–

Warning!
To avoid risk of contamination, install according to the "Hygienic Equipment Design Criteria (HDC)" as stated in the Subgroup Design Principles of the EHEDG, Doc. 8, July 1993.
The flow of liquid during cleaning is important and should be in compliance with the HDC.

Note!
- For CIP (Clean in Place) and SIP (Sterilize in Place) processes the pressure and temperature specifications of the process connections must be observed.
- Suitable fittings and seals must be used to ensure hygiene-compliant design according to 3A, EHEDG, ASME BPE etc.
- Surfaces with ASME-BPE option: Ra < 0.38 µm (< 15 µin) electropolished and passivated or Ra < 1.5 µm (59 µin) mechanically polished.

CRN approval

Versions with a CRN approval (Canadian Registration Number) are marked with a "*" in ordering information feature 20 "process connection" (s. Seite 43 ff.). CRN-approved devices are assigned the registration number 0F10525.5C on the nameplate.

Process seal according to ANSI/ISA 12.27.01

Practice in North America for the installation of process seals
Endress+Hauser devices are designed as either single seal or dual seal devices with an alarm in accordance with ANSI/ISA 12.27.01. This means that the user does need to install for an external secondary process seal in the thermowell which is required in ANSI/NFPA 70 (NEC) and CSA 22.1 (CEC). These devices comply with installation practice in North America and enable very safe, low-cost installation in pressurized applications with hazardous media.
Further information is provided in the Safety Instructions (XA) for the specific device → 58 ff.

Product	Type	Max. process pressure	Marking	Listing
Liquiphant M	FTL50-S/T##... FTL50-P/Q/R##...	64 bar (928 psi)	Single Seal	CSA/FM
	FTL51-S/T##... FTL51-P/Q/R##...	64/100 bar (928/1450 psi)	Single Seal	CSA/FM
	FTL50H-S/T##... FTL50H-P/Q/R##...	64 bar (928 psi)	Single Seal	CSA/FM
	FTL51H-S/T##... FTL51H-P/Q/R##...	64 bar (928 psi)	Single Seal	CSA/FM

Other certificates

- Material certificate as per EN 10204/3.1 for all wetted parts NACE MR0175/MR0103, AD2000
- Leak detection system in conjunction with WHG approval
  Approval number: Z–65.40–446 (see also "Ordering information" s. Seite 43 ff.)
- TSE Certificate of Suitability
  The following applies to wetted device components:
  – They do not contain any materials derived from animals.
  – No additives or operating materials derived from animals are used in production or processing.

Note!
Wetted device components are listed in the "Mechanical construction" (→ 30 ff.) and "Ordering information" (→ 43 ff.) sections.

Manufacturer declarations

The following documents are optionally available to order with the device:

- FDA conformity
- TSE-free: Materials not derived from animals
- Regulation (EC) no. 2023/2006 (GMP)
- Regulation (EC) No. 1935/2004 materials in contact with food

The applicable European guidelines and standards can be found in the relevant EU Declarations of Conformity.

Regulation (EC) no. 10/2011: The regulation on plastic materials does not apply to the Liquiphant FTL5x, as the wetted materials are made exclusively of stainless steel.
The silicone seals supplied comply with BFR recommendation XV (commodities based on silicones from the Federal Institute for Risk Assessment - BFR), and the EPDM seals provided comply with BFR recommendation XXI (commodities based on natural and synthetic rubber).

Use in hazardous zones

Pay particular attention to the information provided in the documentation: Safety Instructions, Control Drawings etc. → 58

ASME B 31.3

Design and materials in accordance with ASME B31.3 The welding seals are through-penetration welded and comply with ASME Boiler and Pressure Vessel Code Section IX and EN ISO 15614-1.

Pressure equipment directive

The pressure equipment directive 97/23/EC does not apply to the Liquiphant FTL5x, as it does not have a pressurized housing in accordance with Article 1, Paragraph 2.1.4 of the directive.

Ordering information

Note!
Versions that are mutually exclusive are not indicated in this list.

Liquiphant M FTL50, FTL51 product structure

Design		*Basic weight*
FTL50	Compact	0.6 kg
FTL51	With extension pipe	0.6 kg

10	**Approval:**
A	Non-hazardous area
B	ATEX II 3G Ex nC IIC T6, WHG, ATEX II 3D Ex tc IIIC T85°C, NEPSI II 3G Ex nC IIC T6
C	ATEX II 3G Ex nA IIC T6, WHG, ATEX II 3D Ex tc IIIC T85°C, NEPSI II 3G Ex nA IIC T6
D	Non-hazardous area, WHG
E	ATEX II 1/2G Ex de IIC T6, WHG
F	ATEX II 1/2GD Ex ia IIC T6, WHG/IECEx
G	ATEX II 1/2GD Ex ia IIC T6/IECEx Zone0/1
H	ATEX II 1G Ex ia IIC T6
I	ATEX II 1/2G Ex de IIC T6/IECEx Zone0/1
J	ATEX II 1G Ex ia IIC T6, WHG
K	ATEX II 1/2G Ex d IIC T6/IECEx Zone0/1
L	ATEX II 1/2G Ex d IIC T6, WHG
M	NEPSI Ex ia IIC T6
N	NEPSI Ex d IIC T6
P	FM IS Cl.I,II,III Div.1 Gr.A-G, Zone 0,1,2,20,21,22
Q	FM XP Cl.I,II,III Div.1 Gr.B-G, Gr.A-G if E5 housing selected, Zone 1,2
R	FM NI Cl.I Div.2 Gr.A-D, Zone 0,1,2,20,21,22
S	CSA C/US IS Cl I,II,III Div.1 Gr.A-G, Zone 0,1,2
T	CSA C/US XP Cl I,II,III Div.1 Gr.A-G, Zone 1,2
U	CSA C/US General Purpose
V	TIIS Ex ia IIC T3
W	TIIS Ex d IIB T3
7	TIIS Ex d IIC T3
8	TIIS Ex d IIC T6
1	INMETRO Ex ia IIC T6 Ga/Gb
2	INMETRO Ex d IIC T6 Ga/Gb
3	INMETRO Ex de IIC T6 Ga/Gb
Y	Special version, TSP-No. to be spec.

20	**Process connection:**			*Additional weight*
Note! For 100 bar (1450 psi) process pressure, select the appropriate option under "Additional option"				
GQ2	G ¾	316L	Thread ISO 228	
	Installation > accessories: weld-in adapter			
GQ6	G ¾	AlloyC22	Thread ISO 228	
GR2	G 1	316L	Thread ISO 228	0.2 kg
GR6	G 1	AlloyC22	Thread ISO 228	0.2 kg
GW2*	G 1	316L	Thread ISO 228	0.2 kg
	Installation > accessories: weld-in adapter			
GM2*	NPT ¾	316L	Thread ASME	
GM6	NPT ¾	AlloyC22	Thread ASME	
GN2*	NPT1	316L	Thread ASME	0.2 kg
GN6	NPT1	AlloyC22	Thread ASME	0.2 kg
GE2	R ¾	316L	Thread EN10226	
GE6	R ¾	AlloyC22	Thread EN10226	
GF2	R 1	316L	Thread EN10226	0.2 kg

20		Process connection:							*Additional weight*
		GF6	R 1			AlloyC22		Thread EN10226	0.2 kg
		BA2	DN32	PN6 A		316L		Flange EN 1092-1 (DIN 2527 B)	1.2 kg
		BB2	DN32	PN25/40 A		316L		Flange EN 1092-1 (DIN 2527 B)	2.0 kg
		BC2	DN40	PN6 A		316L		Flange EN 1092-1 (DIN 2527 B)	1.4 kg
		BD2	DN40	PN25/40 A		316L		Flange EN 1092-1 (DIN 2527 B)	2.4 kg
		BE2	DN50	PN6 A		316L		Flange EN 1092-1 (DIN 2527 B)	1.6 kg
		BG2	DN50	PN25/40 A		316L		Flange EN 1092-1 (DIN 2527 B)	3.2 kg
		BH2	DN65	PN6 A		316L		Flange EN 1092-1 (DIN 2527 B)	2.4 kg
		BJ2	DN50	PN100 A		316L	(FTL51)	Flange EN 1092-1 (DIN 2527 B)	
		BK2	DN65	PN25/40 A		316L		Flange EN 1092-1 (DIN 2527 B)	4.3 kg
		BM2	DN80	PN10/16 A		316L		Flange EN 1092-1 (DIN 2527 B)	4.8 kg
		BN2	DN80	PN25/40 A		316L		Flange EN 1092-1 (DIN 2527 B)	5.9 kg
		BQ2	DN100	PN10/16 A		316L		Flange EN 1092-1 (DIN 2527 B)	5.6 kg
		BR2	DN100	PN25/40 A		316L		Flange EN 1092-1 (DIN 2527 B)	7.5 kg
		B12	DN80	PN100 A		316L	(FTL51)	Flange EN 1092-1 (DIN 2527 B)	
		B82	DN25	PN25/40 A		316L		Flange EN 1092-1 (DIN 2527 B)	1.4 kg
		CA2	DN32	PN6 B1		316L		Flange EN 1092-1 (DIN 2527 C)	1.1 kg
		CA6	DN32	PN6 B1		AlloyC22 >316L		Flange EN 1092-1 (DIN 2527)	1.1 kg
		CE2	DN50	PN6 B1		316L		Flange EN 1092-1 (DIN 2527 C)	1.5 kg
		CE6	DN50	PN6 B1		AlloyC22 >316L		Flange EN 1092-1 (DIN 2527)	1.5 kg
		CG2	DN50	PN25/40 B1		316L		Flange EN 1092-1 (DIN 2527 C)	2.9 kg
		CG6	DN50	PN25/40 B1		AlloyC22 >316L		Flange EN 1092-1 (DIN 2527)	2.9 kg
		CJ2	DN50	PN100 B2		316L	(FTL51)	Flange EN 1092-1 (DIN 2527)	
		CN2	DN80	PN25/40 B1		316L		Flange EN 1092-1 (DIN 2527 C)	5.2 kg
		CN6	DN80	PN25/40 B1		AlloyC22 >316L		Flange EN 1092-1 (DIN 2527)	5.2 kg
		CQ2	DN100	PN10/16 B1		316L		Flange EN 1092-1 (DIN 2527 C)	5.3 kg
		CQ6	DN100	PN10/16 B1		AlloyC22 >316L		Flange EN 1092-1 (DIN 2527)	5.3 kg
		C12	DN80	PN100 B2		316L	(FTL51)	Flange EN 1092-1 (DIN 2527)	
		C82	DN25	PN25/40 B1		316L		Flange EN 1092-1 (DIN 2527 C)	1.3 kg
		C86	DN25	PN25/40 B1		AlloyC22 >316L		Flange EN 1092-1 (DIN 2527)	1.3 kg
		DG2	DN50	PN40 B1		316L		Flange EN 1092-1 (DIN 2526 D)	
		DN2	DN80	PN40 B1		316L		Flange EN 1092-1 (DIN 2526 D)	
		D82	DN25	PN40 B1		316L		Flange EN 1092-1 (DIN 2526 D)	
		EG2	DN50	PN25/40 E		316L		Flange EN 1092-1	2.6 kg
		FG2	DN50	PN40 C		316L		Flange EN 1092-1 (DIN 2512 F)	2.6 kg
		NG2	DN50	PN40 D		316L		Flange EN 1092-1 (DIN 2512 N)	2.9 kg
		AA2*	1¼"	150 lbs	RF	316/316L		Flange ASME B16.5	1.2 kg
		AB2*	1¼"	300 lbs	RF	316/316L	(FTL51)	Flange ASME B16.5	2.0 kg
		AC2*	1½"	150 lbs	RF	316/316L		Flange ASME B16.5	1.5 kg
		AD2*	1½"	300 lbs	RF	316/316L	(FTL51)	Flange ASME B16.5	2.7 kg

20	Process connection:						*Additional weight*
	AE2*	2"	150 lbs	RF	316/316L	Flange ASME B16.5	2.4 kg
	AE6	2"	150 lbs	RF	AlloyC22 >316/316L	Flange ASME B16.5	2.4 kg
	AF2*	2"	300 lbs	RF	316/316L	Flange ASME B16.5	3.2 kg
	AG2*	2"	600 lbs	RF	316/316L (FTL51)	Flange ASME B16.5	4.2 kg
	AJ2*	2½"	300 lbs	RF	316/316L (FTL51)	Flange ASME B16.5	4.8 kg
	AL2*	3"	150 lbs	RF	316/316L	Flange ASME B16.5	4.9 kg
	AM2*	3"	300 lbs	RF	316/316L (FTL51)	Flange ASME B16.5	6.8 kg
	AM6	3"	300 lbs	RF	AlloyC22 >316/316L	Flange ASME B16.5	6.8 kg
	AN2*	3"	600 lbs	RF	316/316L (FTL51)	Flange ASME B16.5	
	AP2*	4"	150 lbs	RF	316/316L	Flange ASME B16.5	7.0 kg
	AQ2*	4"	300 lbs	RF	316/316L (FTL51)	Flange ASME B16.5	11.5 kg
	AQ6	4"	300 lbs	RF	AlloyC22 >316/316L	Flange ASME B16.5	11.5 kg
	AR2*	4"	600 lbs	RF	316/316L (FTL51)	Flange ASME B16.5	17.3 kg
	A82*	1"	150 lbs	RF	316/316L	Flange ASME B16.5	1.0 kg
	KA2	10 K 25 A		RF	316L	Flange JIS B2220	
	KC2	10 K 40 A		RF	316L	Flange JIS B2220	
	KE2	10 K 50 A		RF	316L	Flange JIS B2220	1.7 kg
	KE6	10 K 50 A		RF	AlloyC22 >316L	Flange JIS B2220	1.7 kg
	KL2	10 K 80 A		RF	316L	Flange JIS B2220	
	KP2	10 K 100 A		RF	316L	Flange JIS B2220	
	TC2*	DN25-38 (1 to 1½")			316L	ISO 2852 Tri-Clamp	
	TE2*	DN40-51 (2")			316L	ISO 2852 Tri-Clamp	0.1 kg
	YY9	Special version					
		* With CRN approval.					

30	Probe length; Type:				
	FTL50				
	AA	Compact;		Ra <3.2 µm/126 µin	
	IA	Compact;		Temperature spacer	0.6 kg
	QA	Compact;		Pressure-tight feedthrough	0.7 kg
	FTL51				
	BB	..... mm;	316L**	Ra <3.2 µm/126 µin	
	BE	..... mm;	Alloy**	Ra <3.2 µm/126 µin	
	CB	..... inch;	316L**	Ra <3.2 µm/126 µin	
	CE	..... inch;	Alloy**	Ra <3.2 µm/126 µin	2.3 kg/100 in
	DB	Length: type II*;	316L	Ra <3.2 µm/126 µin	0.1 kg
	DE	Length: type II*;	Alloy	Ra <3.2 µm/126 µin	0.1 kg
	JB	..... mm;	316L**	+ Temperature spacer	0.9 kg/m +0.6 kg
	JE	..... mm;	Alloy**	+ Temperature spacer	0.9 kg/m +0.6 kg
	KB	..... inch;	316L**	+ Temperature spacer	2.3 kg/100 in +0.6 kg
	KE	..... inch;	Alloy**	+ Temperature spacer	2.3 kg/100 in +0.6 kg
	LB	Length: type II*;	316L	+ Temperature spacer	0.1 kg +0.6 kg
	LE	Length: type II*;	Alloy	+ Temperature spacer	0.1 kg +0.6 kg
	RB	..... mm;	316L**	+ Pressure-tight feedthrough	0.9 kg/m +0.7 kg
	RE	..... mm;	Alloy**	+ Pressure-tight feedthrough	0.9 kg/m +0.7 kg
	SB	..... inch;	316L**	+ Pressure-tight feedthrough	2.3 kg/100 in +0.7 kg
	SE	..... inch;	Alloy**	+ Pressure-tight feedthrough	2.3 kg/100 in +0.7 kg
	TB	Length: type II*;	316L	+ Pressure-tight feedthrough	0.1 kg +0.7 kg
	TE	Length: type II*;	Alloy	+ Pressure-tight feedthrough	0.1 kg +0.7 kg
	YY	Special version			
		*) Replacing devices: when vertically mounting a Liquiphant **M** FTL51 with length II, the switch point is at the same height as for a Liquiphant **II** FTL360, FTL365, FDL30, FDL35. See also Seite 36 "L II" depends on process connection.			
		**) Order 3001 to 6000 mm (116 to 235 in) via yy			

40	Electronics; output:		
	A	FEL50A	PROFIBUS PA
	D	FEL50D	Density/concentration without WHG approval (Germany)
	1	FEL51*	2-wire, AC 19 to 253 V
	2	FEL52*	3-wire PNP, DC 10 to 55 V
	4	FEL54	Relay DPDT, AC 19 to 253 V, DC 19 to 55 V
	5	FEL55	8/16 mA, DC 11 to 36 V
	6	FEL56	NAMUR (L-H signal)
	7	FEL57	2-wire PFM
	8	FEL58*	NAMUR + test keys (H-L signal)
	9	Special version	
		*) Also available in compact housing	

50	Housing; cable entry:					
	C3	Compact 316L	IP66/68;	Cable 5 m		
	D3	Compact 316L	IP65;	Plug Pg11	ISO4400	
	E1	F27 316L	NEMA 4X/6P;	Thread NPT ¾		
	E3	Compact 316L Hygiene	NEMA4X;	Plug NPT ½	ISO4400	
	N3	Compact 316L Hygiene	IP66/68;	M12 connector		
	E4	F16 Polyester	NEMA4X;	Thread NPT ½		
	E5	F13 Alu F17 Alu	NEMA4X/6P; NEMA4X	Thread NPT ¾		0.5 kg
	E6	F15 316L hygiene	NEMA4X;	Thread NPT ½		0.1 kg
	E7	T13 Alu	NEMA4X/6P;	Thread NPT ¾		0.9 kg
		Separate connection compartment				
	F1	F27 316L	IP66/68	Thread G1/2		
	F4	F16 Polyester	IP66/67;	Thread G ½		
	F5	F13 Alu F17 Alu	IP66/68; IP66/67;	Thread G ½		0.5 kg
	F6	F15 316L Hygiene	IP66/67;	Thread G ½		0.1 kg
	F7	T13 Alu	coated IP66/68; thread G ½			0.9 kg
		Separate connection compartment				
	G1	F27 316L	IP66/68;	M20 threaded joint		
		Ex d > M20 thread				
	G4	F16 Polyester	IP66/67;	M20 threaded joint		
	G5	F13 Alu F17 Alu	IP66/68; IP66/67;	M20 threaded joint Ex d > thread M20		0.5 kg
	G6	F15 316L Hygiene	IP66/67;	M20 threaded joint		0.1 kg
	G7	T13 Alu	coated IP66/68;	M20 threaded joint		0.9 kg
		Separate connection compartment		Ex d > thread M20		
	N4	F16 Polyester	IP66/67;	M12 connector		
	N5	F13 Alu F17 Alu	IP66/68; IP66/67;	M12 connector		
	N6	F15 316L hygiene	IP66/67;	M12 connector		
	Y9	Special version				

60	Additional option	
	A	Basic version
	B	PWIS-free, PWIS = paint-wetting impairment substances, max 2000 mm (78.7 in)
	C	EN 10204 - 3.1 material (316L wetted) inspection certificate
	D	EN10204-3.1 AD2000 material, wetted, apart from cast parts, inspection certificate
	K	Special adjustment, density H20
	L	Special adjustment, density H20, EN10204-3.1, material (wetted), inspection certificate
	N	EN 10204 - 3.1 material, NACE MR0175 (316L wetted) Inspection certificate
	P	100 bar (1450 psi) process pressure (FTL51)
	R	100 bar (1450 psi) process pressure, EN 10204 - 3.1 material, NACE MR0175 (316L wetted) Inspection certificate (FTL51)
	S	GL/ABS marine approval for FTL51: ≤ 1600 mm (63 in)
	Y	Special version

580								Test, certificate:
							KD	Helium leak test, internal procedure, inspection certificate
							KE	Pressure test, internal procedure, inspection certificate
							KG	PMI test (XRF), internal procedure, wetted metal parts, EN10204-3.1 inspection certificate
							KP	Dye penetration test AD2000-HP5-3(PT), wetted/pressurized metal parts, inspection certificate
							KQ	Dye penetration test ISO23277-1 (PT), wetted/pressurized metal parts, inspection certificate
							KR	Dye penetration test ASME VIII-1 (PT), wetted/pressurized metal parts, inspection certificate
							KS	Welding documentation, wetted/pressurized seams
							KV	Declaration of Conformity ASME B31.3
							K9	Special version, TSP-No. to be spec.
FTL5x –								Complete product designation

Note!
The basic weight includes the compact sensor, thread adapter G ¾, electronic insert, polyester housing

Liquiphant M FTL50H, FTL51H product structure

Design		*Basic weight*
FTL50H	Compact	0.7 kg
FTL51H	With extension pipe	0.7 kg

10		Approval:
	A	Non-hazardous area
	B	ATEX II 3G Ex nC IIC T6, WHG, ATEX II 3D Ex tc IIIC T85°C, NEPSI II 3G Ex nC IIC T6
	C	ATEX II 3G Ex nA IIC T6, WHG, ATEX II 3D Ex tc IIIC T85°C, NEPSI II 3G Ex nA IIC T6
	D	Non-hazardous area, WHG
	E	ATEX II 1/2G Ex de IIC T6, WHG
	F	ATEX II 1/2GD Ex ia IIC T6, WHG/IECEx
	G	ATEX II 1/2GD Ex ia IIC T6/IECEx Zone0/1
	H	ATEX II 1G Ex ia IIC T6
	I	ATEX II 1/2G Ex de IIC T6/IECEx Zone0/1
	J	ATEX II 1G Ex ia IIC T6, WHG
	K	ATEX II 1/2G Ex d IIC T6/IECEx Zone0/1
	L	ATEX II 1/2G Ex d IIC T6, WHG
	M	NEPSI Ex ia IIC T6
	N	NEPSI Ex d IIC T6
	P	FM IS Cl.I,II,III Div.1 Gr.A-G, Zone 0,1,2,20,21,22
	Q	FM XP Cl.I,II,III Div.1 Gr.B-G, Gr.A-G if E5 housing selected, Zone 1,2
	R	FM NI Cl.I Div.2 Gr.A-D, Zone 0,1,2,20,21,22
	S	CSA C/US IS Cl I,II,III Div.1 Gr.A-G, Zone 0,1,2
	T	CSA C/US XP Cl I,II,III Div.1 Gr.A-G, Zone 1,2
	U	CSA C/US General Purpose
	V	TIIS Ex ia IIC T3
	W	TIIS Ex d IIB T3
	7	TIIS Ex d IIC T3
	8	TIIS Ex d IIC T6
	1	INMETRO Ex ia IIC T6 Ga/Gb
	2	INMETRO Ex d IIC T6 Ga/Gb
	3	INMETRO Ex de IIC T6 Ga/Gb
	Y	Special version, TSP-No. to be spec.

20		Process connection:					*Additional weight*
	GQ2	G ¾		316L	(FTL50H)	Thread ISO 228	
		Installation > accessories: weld-in adapter					
	GW2*	G 1		316L		Thread ISO 228	0.2 kg
		Installation > accessories: weld-in adapter					
	BA2	DN32	PN6 A	316L		Flange EN 1092-1 (DIN 2527 B)	1.2 kg
	BB2	DN32	PN25/40 A	316L		Flange EN 1092-1 (DIN 2527 B)	2.0 kg
	BC2	DN40	PN6 A	316L		Flange EN 1092-1 (DIN 2527 B)	1.4 kg
	BD2	DN40	PN25/40 A	316L		Flange EN 1092-1 (DIN 2527 B)	2.4 kg
	BE2	DN50	PN6 A	316L		Flange EN 1092-1 (DIN 2527 B)	1.6 kg

20		Process connection:						*Additional weight*
		BG2	DN50	PN25/40 A		316L	Flange EN 1092-1 (DIN 2527 B)	3.2 kg
		BH2	DN65	PN6 A		316L	Flange EN 1092-1 (DIN 2527 B)	2.4 kg
		BK2	DN65	PN25/40 A		316L	Flange EN 1092-1 (DIN 2527 B)	4.3 kg
		BM2	DN80	PN10/16 A		316L	Flange EN 1092-1 (DIN 2527 B)	4.8 kg
		BN2	DN80	PN25/40 A		316L	Flange EN 1092-1 (DIN 2527 B)	5.9 kg
		BQ2	DN100	PN10/16 A		316L	Flange EN 1092-1 (DIN 2527 B)	5.6 kg
		BR2	DN100	PN25/40 A		316L	Flange EN 1092-1 (DIN 2527 B)	7.5 kg
		B82	DN25	PN25/40 A		316L	Flange EN 1092-1 (DIN 2527 B)	1.4 kg
		CG2	DN50	PN25/40 B1		316L	Flange EN 1092-1 (DIN 2527 C)	3.2 kg
		CN2	DN80	PN25/40 B1		316L	Flange EN 1092-1 (DIN 2527 C)	5.9 kg
		CQ2	DN100	PN10/16 B1		316L	Flange EN 1092-1 (DIN 2527 C)	5.6 kg
		EE2	1" flush-mounted (52001047)			316L		0.3 kg
			Installation > accessories: weld-in adapter					
		HE2	DN50	Pipe DIN 11850 slotted nut		316L	DIN 11864-1 A	0.3 kg
		AA2*	1¼"	150 lbs	RF	316/316L	Flange ASME B16.5	1.2 kg
		AC2*	1½"	150 lbs	RF	316/316L	Flange ASME B16.5	1.5 kg
		AE2*	2"	150 lbs	RF	316/316L	Flange ASME B16.5	2.4 kg
		AF2*	2"	300 lbs	RF	316/316L	Flange ASME B16.5	3.2 kg
		AJ2*	2½"	300 lbs	RF	316/316L (FTL51H)	Flange ASME B16.5	4.8 kg
		AL2*	3"	150 lbs	RF	316/316L	Flange ASME B16.5	4.9 kg
		AM2	3"	300 lbs	RF	316/316L (FTL51H)	Flange ASME B16.5	6.8 kg
		AP2*	4"	150 lbs	RF	316/316L	Flange ASME B16.5	7.0 kg
		AQ2*	4"	300 lbs	RF	316/316L (FTL51H)	Flange ASME B16.5	11.5 kg
		A82*	1"	150 lbs	RF	316/316L	Flange ASME B16.5	1.0 kg
		KA2	10 K 25		RF	316L	Flange JIS B2220	
		KC2	10 K 40		RF	316L	Flange JIS B2220	
		KE2	10 K 50		RF	316L	Flange JIS B2220	1.7 kg
		KL2	10 K 80		RF	316L	Flange JIS B2220	
		KP2	10 K 100		RF	316L	Flange JIS B2220	
		MA2	DN32	PN25		316L	DIN 11851	0.1 kg
		MC2	DN40	PN25		316L	DIN 11851	0.2 kg
		ME2	DN50	PN25		316L	DIN 11851	0.3 kg
		PE2	DRD	65 mm		316L		0.3 kg
		TC2*	DN25-38 (1 to 1½")			316L	ISO 2852 Tri-Clamp	
		TE2*	DN40-51 (2")			316L	ISO 2852 Tri-Clamp	0.1 kg
		TT2	Ingold fitting 25x46mm			316L		
		UE2	SMS 2"	PN25		316L		0.2 kg
		WE2*	DN65-162 PN10			316L	Varivent N pipe	0.5 kg
		YY9	Special version					
			* CRN approval					

30			Probe length; Type:		
			FTL50H		
		AC	Compact;	Ra <1.5 µm/59 µin	
		AD	Compact;	Ra <0.3 µm/12 µin	
		AF	Compact;	Ra<0.76 µm/30 µin	
		IC	Compact;	Ra <1.5 µm/59 µin + temperature spacer	0.6 kg
		ID	Compact;	Ra <0.3 µm/12 µin / A3 + temperature spacer	0.6 kg
		QC	Compact;	Ra <1.5 µm/59 µin + pressure-tight feedthrough	0.7 kg
		QD	Compact;	Ra <0.3 µm/12 µin / A3 + pressure-tight feedthrough	0.7 kg
			FTL51H		
		BC	..... mm;	Ra <1.5 µm/59 µin	0.9 kg/m
		BD	..... mm;	Ra <0.3 µm/12 µin / A3	0.9 kg/m
		BF	.....mm;	Ra<0.76 µm/30 µin	0.9 kg/m
		CC	..... inch;	Ra <1.5 µm/59 µin	2.3 kg/100 in
		CD	..... inch;	Ra <0.3 µm/12 µin / A3	2.3 kg/100 in
		cf	.....inch;	Ra<0.76 µm/30 µin	2.3 kg/100 in

30	Probe length; Type:		
DC	Length: type II*;	Ra <1.5 µm/59 µin	0.1 kg
DD	Length: type II*;	Ra <0.3 µm/12 µin / A3	0.1 kg
JC	..... mm;	Ra <1.5 µm/59 µin + Temperature spacer	0.9 kg/m +0.6 kg
JD	..... mm;	Ra <0.3 µm/12 µin + Temperature spacer	0.9 kg/m +0.6 kg
KC	..... inch;	Ra <1.5 µm/59 µin + Temperature spacer	2.3 kg/100 in +0.6 kg
KD	..... inch;	Ra <0.3 µm/12 µin + Temperature spacer	2.3 kg/100 in +0.6 kg
LC	Length: type II*;	Ra <1.5 µm/59 µin + Temperature spacer	0.1 kg +0.6 kg
LD	Length: type II*;	Ra <0.3 µm/12 µin + Temperature spacer,	0.1 kg +0.6 kg
RC	..... mm;	Ra <1.5 µm/59 µin + Pressure-tight feedthrough	0.9 kg/m +0.7 kg
RD	..... mm;	Ra <0.3 µm/12 µin + Pressure-tight feedthrough	0.9 kg/m +0.7 kg
SC	..... inch;	Ra <1.5 µm/59 µin + Pressure-tight feedthrough	2.3 kg/100 in +0.7 kg
SD	..... inch;	Ra <0.3 µm/12 µin + Pressure-tight feedthrough	2.3 kg/100 in +0.7 kg
TC	Length: type II*;	Ra <1.5 µm/59 µin + Pressure-tight feed through,	0.1 kg +0.7 kg
TD	Length: type II*;	Ra <0.3 µm/12 µin + Pressure-tight feed through,	0.1 kg +0.7 kg
YY	Special version		

*) Replacing devices: when vertically mounting a Liquiphant **M** FTL51H with length II, the switch point is at the same height as for a Liquiphant **II** FTL360, FTL365, FDL30, FDL35.
See also Seite 36 "L II" depends on process connection.

40	Electronics; output:		
A	FEL50A	PROFIBUS PA	
D	FEL50D	Density/concentration without WHG approval (Germany)	
1	FEL51*	2-wire,	AC 19 to 253 V
2	FEL52*	3-wire PNP,	DC 10 to 55 V
4	FEL54	Relay DPDT,	AC 19 to 253 V, DC 19 to 55 V
5	FEL55	8/16 mA,	DC 11 to 36 V
6	FEL56	NAMUR (L-H signal)	
7	FEL57	2-wire PFM	
8	FEL58*	NAMUR + test keys (H-L signal)	
9	Special version		

*) Also available in compact housing

50	Housing; cable entry:				
C3	Compact 316L	IP66/68;	Cable 5 m		
D3	Compact 316L	IP65;	Plug Pg11	ISO4400	
E3	Compact 316L Hygiene	NEMA4X;	Plug NPT ½	ISO4400	
N3	Compact 316L Hygiene	IP66/68;	M12 connector		
E4	F16 Polyester	NEMA4X;	Thread NPT ½		
E5	F13 Alu F17 Alu	NEMA4X/6P; NEMA4X	Thread NPT ¾		0.5 kg
E6	F15 316L Hygiene	NEMA4X;	Thread NPT ½		0.1 kg
E7	T13 Alu	NEMA4X/6P;	Thread NPT ¾		0.9 kg
	Separate connection compartment				
F4	F16 Polyester	IP66/67;	Thread G ½		
F5	F13 Alu F17 Alu	IP66/68; IP66/67;	Thread G ½		0.5 kg
F6	F15 316L hygiene	IP66/67;	Thread G ½		0.1 kg
F7	T13 Alu	coated IP66/68; thread G ½			0.9 kg
	Separate connection compartment				
	Ex d > M20 thread				
G4	F16 Polyester	IP66/67;	M20 threaded joint		
G5	F13 Alu F17 Alu	IP66/68; IP66/67;	M20 threaded joint Ex d > thread M20		0.5 kg
G6	F15 316L Hygiene	IP66/67;	M20 threaded joint		0.1 kg
G7	T13 Alu	coated IP66/68;	M20 threaded joint		0.9 kg

50					**Housing; cable entry:**			
						Separate connection compartment		Ex d > thread M20
					N4	F16 Polyester	IP66/67;	M12 connector
					N5	F13 Alu F17 Alu	IP66/68; IP66/67;	M12 connector
					N6	F15 316L hygiene	IP66/67;	M12 connector
					Y9	Special version		

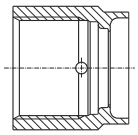
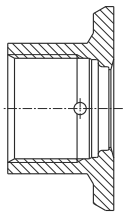
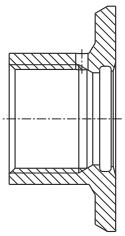
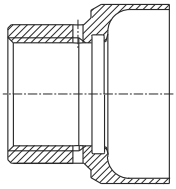
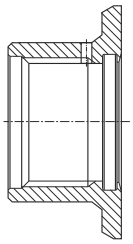
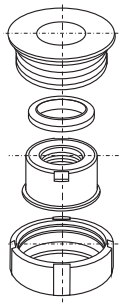
60						**Additional option**	
						A	Basic version
						B	CoC-ASME BPE, EN10204-3.1 material (316L wetted) Inspection certificate
						C	EN 10204 - 3.1 material (316L wetted), Inspection certificate
						D	EN10204-3.1 AD2000 material, wetted, apart from cast parts, inspection certificate
						K	Special adjustment, density H2O
						L	Special adjustment, density H2O, EN10204-3.1 (316L wetted) inspection certificate
						S	GL/ABS marine approval for FTL51H: ≤ 1600 mm (63 in)
						Y	Special version
FTL5#H -							Complete product designation

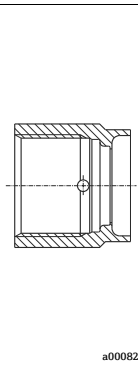
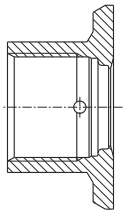
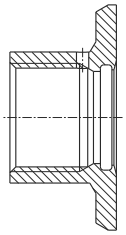
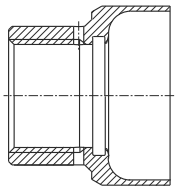
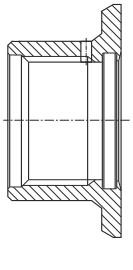
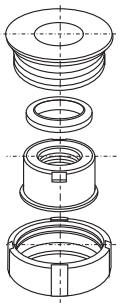
Note!
Basic weight = compact sensor, thread adapter G ¾, electronic insert, stainless steel housing

Accessories

Note!
- All dimensions in mm (in)!
- For additional information on weld-in adapters, refer to TI00426F.
- The tolerance of the thread start between the weld-in adapter and sensor is ± 15°.

Weld-in adapter **Overview**

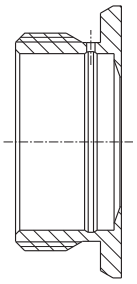
	 a0008246	 a0008251	 a0008256	 a0011924	 a0008248	 a0008253
	G¾, d=29 (1.14) without flange	**G¾, d=50 (1.97) with flange**	**G¾, d=55 (2.17) with flange**	**G1, d=53 (2.09) without flange**	**G1, d=60 (2.36) with flange**	**G1 can be positioned**
Material roughness µm (µin)	316L 1.5 (59.1)	316L 0.8 (31.5)	316L 0.8 (31.5)	316L 0.8 (31.5)	316L 0.8 (31.5)	316L 0.8 (31.5)
Without inspection certificate EN10204-3.1 material	71258357	71258355	52001052[3)]	71258358	52001051[1), 3)]	52001221[2), 3)]
With inspection certificate EN10204-3.1 material	52028295[3)]	52018765[3)]	52011897[3)]	71093129[1), 3)]	52011896[1), 3)]	52011898[2), 3)]
Seal (replacement part: set of 5)	Silicone O-ring 52021717	Silicone O-ring 52021717	Silicone O-ring 52014473	Silicone O-ring 52014472	Silicone O-ring 52014472	Silicone profile gasket 52014424)
Weld-in dummy	–	–	71168889	71166879	71166879	71181945

		 a0008246	 a0008251	 a0008256	 a0011924	 a0008248	 a0008253
		G¾, d=29 (1.14) without flange	**G¾, d=50 (1.97) with flange**	**G¾, d=55 (2.17) with flange**	**G1, d=53 (2.09) without flange**	**G1, d=60 (2.36) with flange**	**G1 can be positioned**
Liquiphant M	Feature	**Version**					
FTL50	020			GQ2			
FTL5x					GW2	GW2	GW2
FTL50H				GQ2			
FTL5xH					GW2	GW2	GW2

1) This weld-in adapter replaces the weld-in adapter with the order number 917969-1000.

2) This weld-in adapter replaces the weld-in adapter with the order number 215159-0000.

3) A seal is included in the delivery.

		 a0008252	a0008254
		RD52	**DRD DN50 65 (2.56) (welding flange)**
Material roughness µm (µin), process side		316L 0.8 (31.5)	316L/304 0.8 (31.5)
Without inspection certificate EN10204-3.1 material		52001047 [1), 2)]	52002041[2)]/ 916743-0000
With inspection certificate EN10204-3.1 material		52006909 [1), 2)]	52011899[2)]/ –
Seal (replacement part: set of 5)		Silicone profile gasket 52014424	PTFE flat seal 52024228
Weld-in dummy		M40167	–
Device	Feature	**Version**	
Liquiphant M			
FTL5xH	020	EE2	PE2

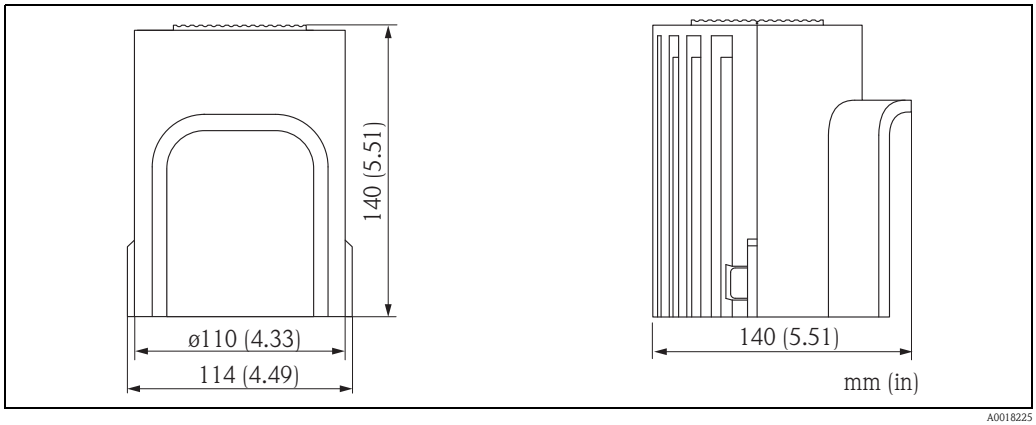
1) This weld-in adapter replaces the weld-in adapter with the order number 942329-0001.

2) A seal is included in the delivery.

Note!
All the weld-in adapters available are described in document TI00426F.
www.endress.com --> Download -->Advanced--> Documentation code --> TI00426F.

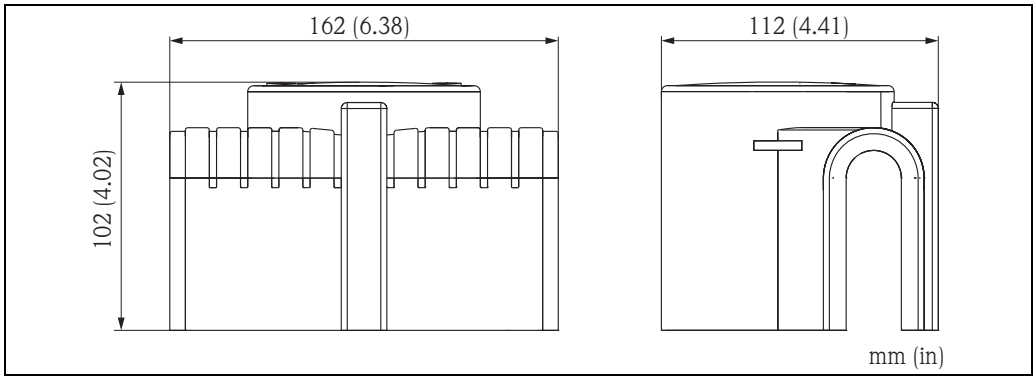
Weather protection cover

For F16 housing



Material	Order No.	Weight
PBT, gray	71127760	240 g (8.46 oz)

For F13, F17 and F27 housing



Material	Order No.	Weight
PA6, gray	71040497	300 g (10.58 oz)

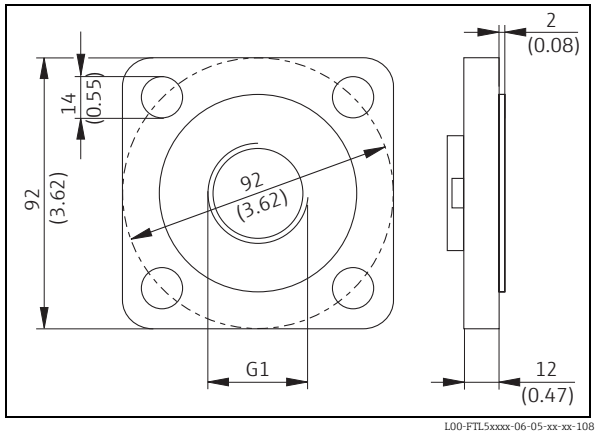
Lap joint flange

Order number: 918158-0000
With G 1 thread for mounting
a Liquiphant FTL50, FTL51
with process connection GR2

Pressure up to 40 bar (580 psi)

Material: corrosion-resistant steel
1.4301 (AISI 304)

Weight: 0.54 kg (1.19 lbs)

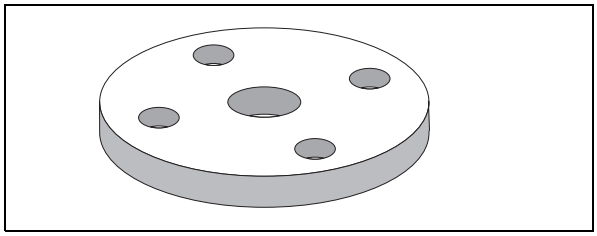


Lap joint flanges

With G 1 thread for mounting
a Liquiphant FTL50, FTL51
with process connection GR2

Material: corrosion-resistant steel
1.4571 (AISI 316Ti)

- Order number: 918143-0000
  Flange DN50 PN40, EN 1092-1
  Weight: 3.11 kg (6.86 lbs)
- Order number: 918144-0000
  Flange ASME 2", 150 psi, RF
  Weight: 2.38 kg (5.25 lbs)



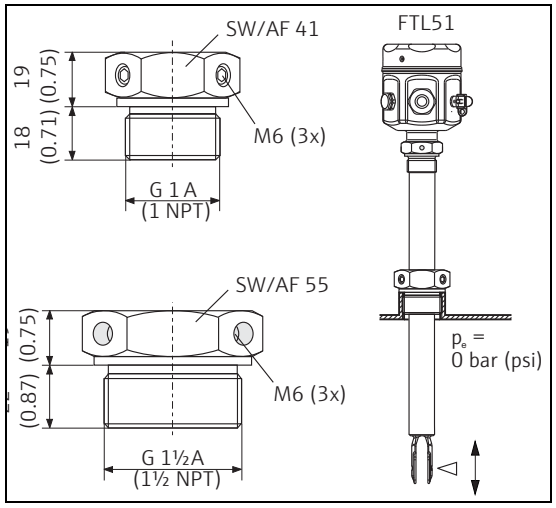
L00-FTL5xxxx-03-05-xx-xx-015

Sliding sleeves for unpressurized operation

Switch point infinitely variable for
Liquiphant M FTL51

Material: corrosion-resistant steel
1.4435 (AISI 316 L)

Weight for G 1, NPT 1: 0.21 kg (0.46 lbs)
Weight for G 1½, NPT 1½: 0.54 kg (1.19 lbs)



L00-FTL5xxxx-06-05-xx-xx-109

Thread	Standard	Material	Order number	Approval
G 1	DIN ISO 228/I	1.4435 (AISI 316 L)	52003978	
G 1	DIN ISO 228/I	1.4435 (AISI 316 L)	52011888	With inspection certificate EN 10204 - 3.1 material
NPT1	ASME B 1.20.1	1.4435 (AISI 316 L)	52003979	
NPT1	ASME B 1.20.1	1.4435 (AISI 316 L)	52011889	With inspection certificate EN 10204 - 3.1 material
G 1½	DIN ISO 228/I	1.4435 (AISI 316 L)	52003980	
G 1½	DIN ISO 228/I	1.4435 (AISI 316 L)	52011890	With inspection certificate EN 10204 - 3.1 material
NPT1½	ASME B 1.20.1	1.4435 (AISI 316 L)	52003981	
NPT1½	ASME B 1.20.1	1.4435 (AISI 316 L)	52011891	With inspection certificate EN 10204 - 3.1 material

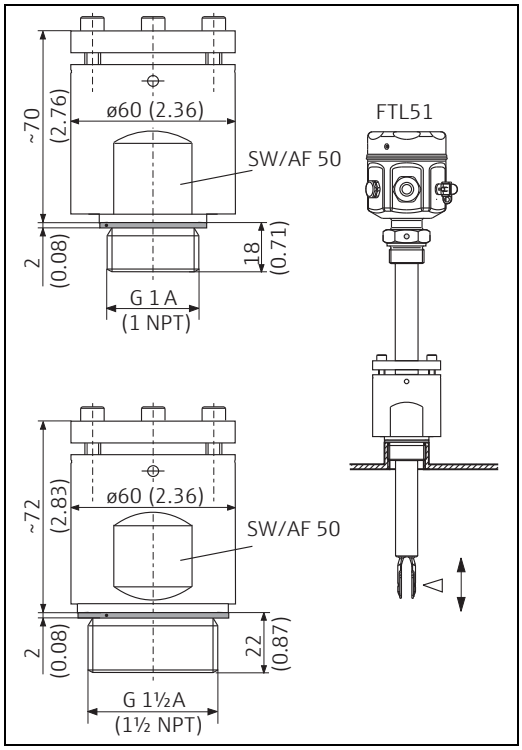
High pressure sliding sleeves

For continuous adjustment of the switch point of a Liquiphant M FTL51.
Also for use in hazardous areas. For further information → 📄 58ff. (ATEX, NEPSI).

Material: corrosion-resistant steel 1.4435 (AISI 316L) or AlloyC22

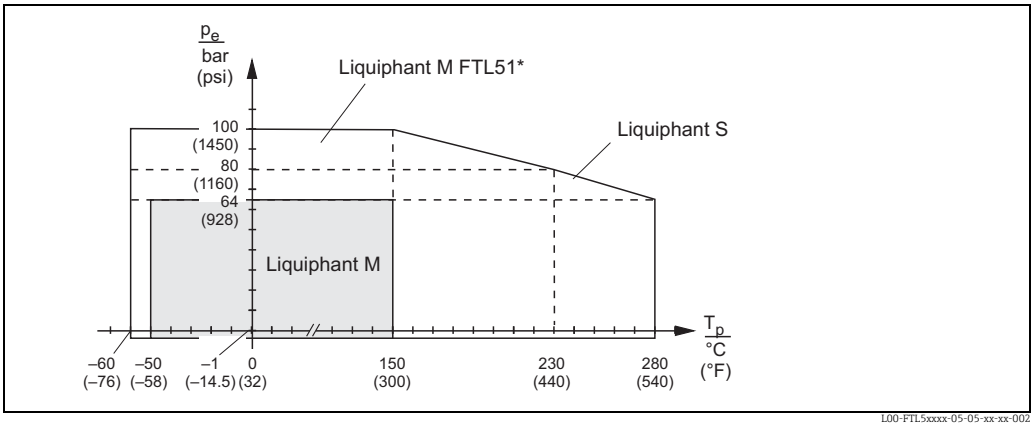
Weight for G 1, NPT 1: 1.13 kg (2.49 lbs)
Weight for G 1½, NPT 1½: 1.32 kg (2.91 lbs)

Seal package made of graphite



L00-FTL5xxxx-06-05-xx-xx-110

Thread	Standard	Material	Order number	Approval
G 1	DIN ISO 228/1	1.4435 (AISI 316 L)	52003663	
G 1	DIN ISO 228/1	1.4435 (AISI 316 L)	52011880	With inspection certificate EN 10204 - 3.1 material
G 1	DIN ISO 228/1	AlloyC22	71118691	With inspection certificate EN 10204 - 3.1 material
NPT1	ASME B 1.20.1	1.4435 (AISI 316 L)	52003667	
NPT1	ASME B 1.20.1	1.4435 (AISI 316 L)	52011881	With inspection certificate EN 10204 - 3.1 material
NPT1	ASME B 1.20.1	AlloyC22	71118694	With inspection certificate EN 10204 - 3.1 material
G 1½	DIN ISO 228/1	1.4435 (AISI 316 L)	52003665	
G 1½	DIN ISO 228/1	1.4435 (AISI 316 L)	52011882	With inspection certificate EN 10204 - 3.1 material
G 1½	DIN ISO 228/1	AlloyC22	71118693	With inspection certificate EN 10204 - 3.1 material
NPT1½	ASME B 1.20.1	1.4435 (AISI 316 L)	52003669	
NPT1½	ASME B 1.20.1	1.4435 (AISI 316 L)	52011883	With inspection certificate EN 10204 - 3.1 material
NPT1½	ASME B 1.20.1	AlloyC22	71118695	With inspection certificate EN 10204 - 3.1 material



L00-FTL5xxxx-05-05-xx-xx-002

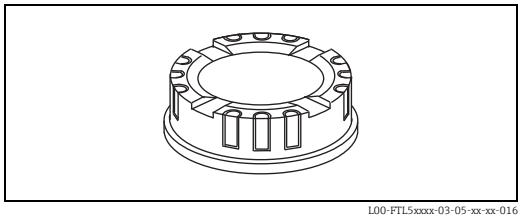
** FTL51 with high-pressure sliding sleeve (100 bar (1450 psi)). See "Additional option" Seite 43 ff. option "P" or "R".l*

Cover with sight glass

Order number: 943461-0001
for polyester housing F16

Material: PA 12

Weight: 0.04 kg (0.09 lbs)



L00-FTL5xxxx-03-05-xx-xx-016

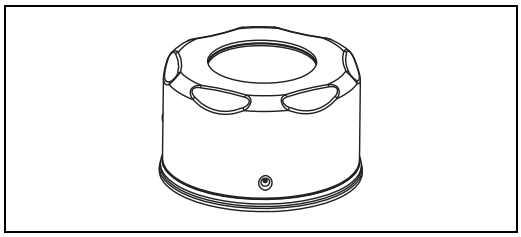
Cover with sight glass

For stainless steel housing F15

Material: AISI 316L

Weight: 0.16 kg (0.35 lbs)

- Order number: 52027002
  With glass sight glass
- Order number: 52028207
  With PC sight glass
  (Not for CSA, General Purpose)



L00-FTL5xxxx-03-05-xx-xx-017

Circular connector

Order number: 52010285

4x0.34 M12 socket

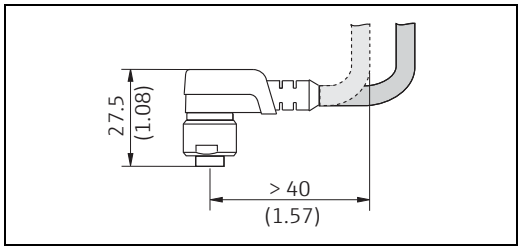
Cable: PVC (gray) 5 m (16 ft)

Body: PUR (blue)

Thread adapter nut: Cu Sn/Ni

Degree of protection: IP67

Temperature range: –25 to +70 °C (-13 to +158 °F)



L00-FTL5xxxx-06-05-xx-xx-111

Order number: 52024216

4x0.34 M12 socket

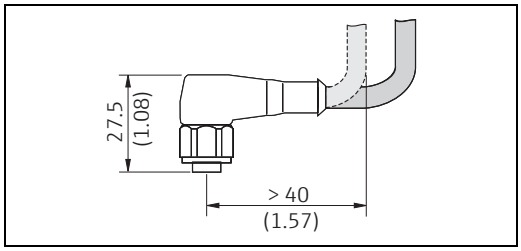
Cable: PVC (orange) 5 m (16 ft)

Body: PVC (orange)

Thread adapter nut: 316L

Degree of protection: IP69K (fully locked)

Temperature range: –25 to +70 °C (-13 to +158 °F)



L00-FTL5xxxx-06-05-xx-xx-112

Order number: 52018763

4x0.34 M12 socket with integrated LEDs

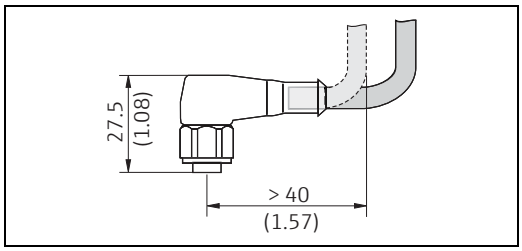
Cable: PVC (orange) 5 m (16 ft)

Body: PVC (transparent)

Thread adapter nut: 316L

Degree of protection: IP69K (fully locked)

Temperature range: –25 to +70 °C (-13 to +158 °F)



Documentation

Note!
You can find supplementary documentation on the product pages at www.endress.com

Operating Instructions

Electronic insert FEL50A for Liquiphant M, PROFIBUS PA
BA00141F

Liquiphant M Density, Density Computer FML621
BA00335F

Liquiphant M FTL50, FTL51
KA00143F

Liquiphant M FTL50(H), FTL51(H)
KA00144F

Liquiphant M FTL51C
KA00162F

Liquiphant M FTL50-####### # 7 #, FTL51-####### # 7 #
KA00163F

Liquiphant M FTL50H-######## 7 #, FTL51H-######## 7 #
KA00164F

Liquiphant M FTL51C-######## 7 ##
KA00165F

Liquiphant M FTL5#-# ### ## # #3 #, FTL5#H-# ### ## # #3 #
KA00220F

Electronic insert FEL50D for Liquiphant M Density FTL50, FTL51
KA00284F

Electronic insert FEL50D for Liquiphant M Density FTL50H, FTL51H
KA00285F

Electronic insert: FEL50D for Liquiphant M Density FTL51C
KA00286F

Liquiphant M Sliding Sleeve for FTL51, G 1, NPT 1
KA00151F

Liquiphant M Sliding Sleeve for FTL51, G 1½, NPT 1½
KA00152F

Liquiphant M High-pressure Sliding Sleeve for FTL51, G 1, NPT 1
KA00153F

Liquiphant M High-pressure Sliding Sleeve for FTL51, G 1½, NPT 1½
KA00154F

Technical Information	General instructions for electromagnetic compatibility (Test procedure, installation recommendation) TI00241F Liquiphant M FTL51C, wetted parts with highly corrosion-resistant ECTFE, PFA or enamel coating TI00347F Isolating amplifier FTL325P, 1 or 3-channel switching units for top-hat rail mounting for Liquiphant M with electronic insert FEL57 TI00350F Isolating amplifier FTL325N, 1 or 3-channel switching units for top-hat rail mounting for Liquiphant M with electronic insert FEL56, FEL58 TI00353F Liquiphant S FTL70/71, for medium temperatures up to 280 °C (536 °F) TI00354F Isolating amplifier FTL375P, 1 to 3-channel switching units for top-hat rail mounting for Liquiphant M with electronic insert FEL57 TI00360F Liquiphant M Density, Density Calculator FML621 TI00420F Weld-in adapter, TI00426F
Functional safety (SIL)	Liquiphant M with electronic insert FEL51 (MAX) SD00164F Liquiphant M with electronic insert FEL51 (MIN) SD00185F Liquiphant M with electronic insert FEL52 (MAX) SD00163F Liquiphant M with electronic insert FEL52 (MIN) SD00186F Liquiphant M with electronic insert FEL54 (MAX) SD00162F Liquiphant M with electronic insert FEL54 (MIN) SD00187F Liquiphant M with electronic insert FEL55 (MAX) SD00167F Liquiphant M with electronic insert FEL55 (MIN) SD00279F Liquiphant M with electronic insert FEL57 + Nivotester FTL325P (MAX) SD00111F Liquiphant M with electronic insert FEL57 + Nivotester FTL325P (MIN) SD00231F Liquiphant M with electronic insert FEL57+ Nivotester FTL375P (MAX) SD00113F Liquiphant M with electronic insert FEL56 + Nivotester FTL325N (MAX) SD00168F Liquiphant M with electronic insert FEL56 + Nivotester FTL325N (MIN) SD00188F Liquiphant M with electronic insert FEL58 + Nivotester FTL325N (MAX) SD00161F Liquiphant M with electronic insert FEL58 + Nivotester FTL325N (MIN) SD00170F

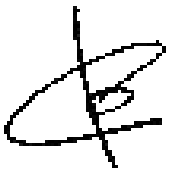
Safety Instructions (ATEX)	CE ⟨Ex⟩ II 1/2 G, Ex d IIC/B (KEMA 99 ATEX 1157) XA00031F/00/a3 CE ⟨Ex⟩ II 1/2 G, Ex ia/ib IIC/B (KEMA 99 ATEX 0523) XA00063F/00/a3 CE ⟨Ex⟩ II 1 G, Ex ia IIC/B (KEMA 99 ATEX 5172 X) XA00064F/00/a3 CE ⟨Ex⟩ II 1/2 G, Ex de IIC/B (KEMA 00 ATEX 2035) XA00108F/00/a3 CE ⟨Ex⟩ II 3 G, Ex nA/nC II (EG 01 007-a) XA00182F/00/a3
Safety Instructions (NEPSI)	Ex d IIC/IIB T3-T6 , Ex d IIC T2-T6 (NEPSI GYJ06424) XA00401F/00/B2 Ex ia IIC T2-T6, Ex ia IIB T3-T6 (NEPSI GYJ05556, NEPSI GYJ06464), XC00009F/00/b2 Ex nA II T3-T6, Ex nC/nL IIC T3-T6 (NEPSI GYJ04360, NEPSI GYJ071414) XC00010F/00/b2
Control Drawings	Liquiphant M (IS and NI) Current output PFM, NAMUR Entity installation Class I, Div. 1, 2, Groups A, B, C, D Class I, Zone 0 Class II, Div. 1, 2, Groups E, F, G Class III ZD00041F Liquiphant M, Liquiphant S (cCSAus / IS) Class I, Div. 1, Groups A, B, C, D Ex ia IIC T6 Class II, Div. 1, Groups E, F, G Class III ZD00042F Liquiphant M (NI), FTL50(H), FTL51(H), FTL51C, FTL70, FTL71 Class I, Div. 2, Groups A, B, C, D Class II, Div. 2, Groups F, G Class III ZD00043F Liquiphant M, Liquiphant S (cCSAus / XP) Class I, Groups A, B, C, D Class II, Groups E, F, G Class III ZD00240F Liquiphant M (IS and NI) PROFIBUS PA, FOUNDATION Fieldbus Class I, Zone 0, IIC Class I, Division 1, 2, Groups A, B, C, D Class II, Division 1, 2, Groups E, F, G Class III ZD00244F
System information	Liquiphant M SI00040F

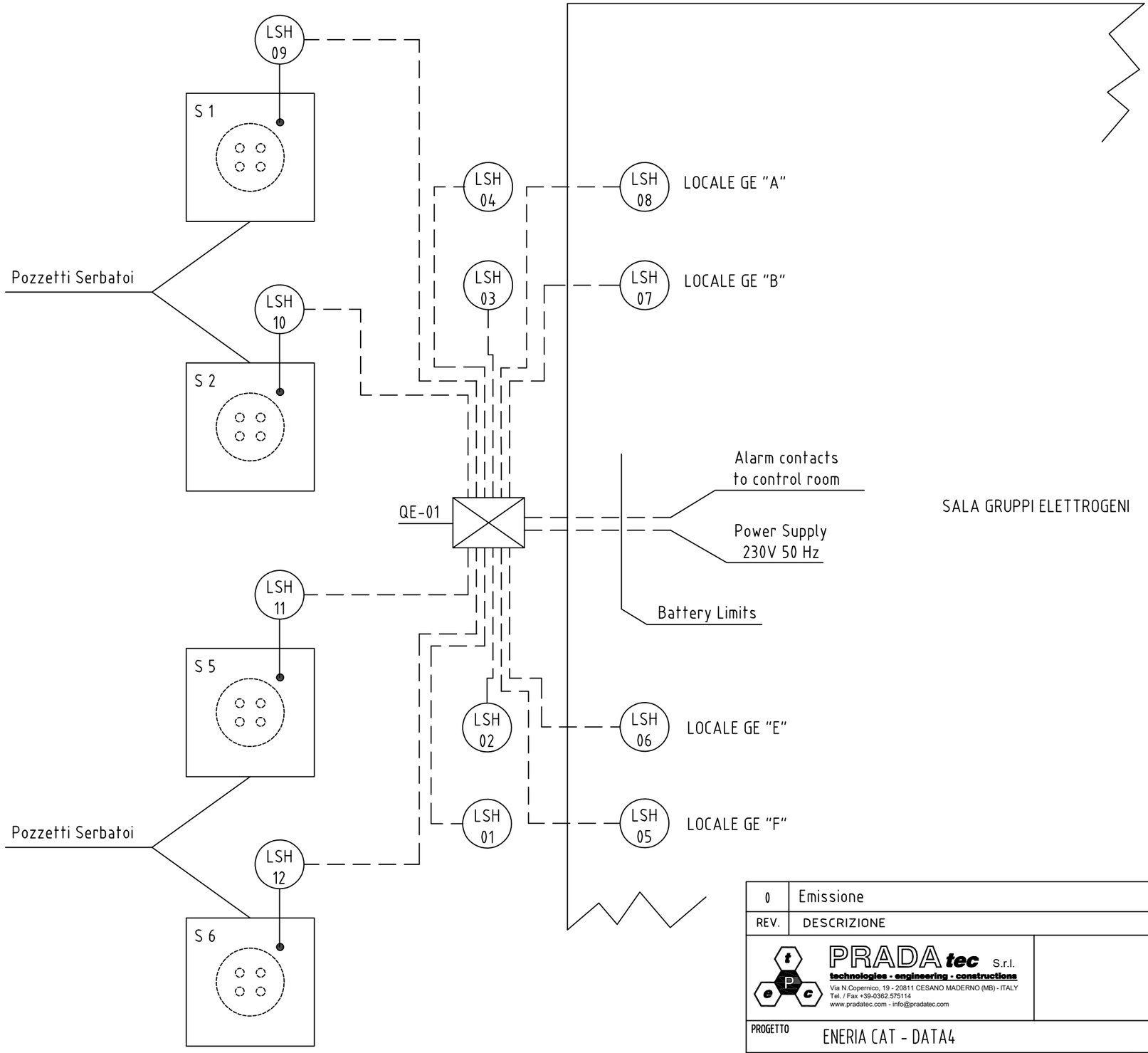
www.addresses.endress.com

Endress+Hauser

People for Process Automation

SCHEMA FUNZIONALE





REV.	DESCRIZIONE	DATA	DISEGN.	CONT.	APPR.
0	Emissione	31/03/23	COGI	COGI	PRCE.

PRADAtec S.r.l.
technologies - engineering - constructions
Via N.Copernico, 19 - 20811 CESANO MADERNO (MB) - ITALY
Tel. / Fax +39-0362.575114
www.pradatec.com - info@pradatec.com

CLIENTE: IMPIANTI ENERGIA - ENERIA CAT

LOCALITA': SETTIMO MILANESE (MI)

PROGETTO: ENERIA CAT - DATA4

COMM. CLIENTE:

TITOLO: SCHEMA FUNZIONALE
RILEVAZIONE PERDITE COMBUSTIBILE
DATACENTER DC L07

COMMESSA: 609

ITEM:

FORMATO:

SCALA:

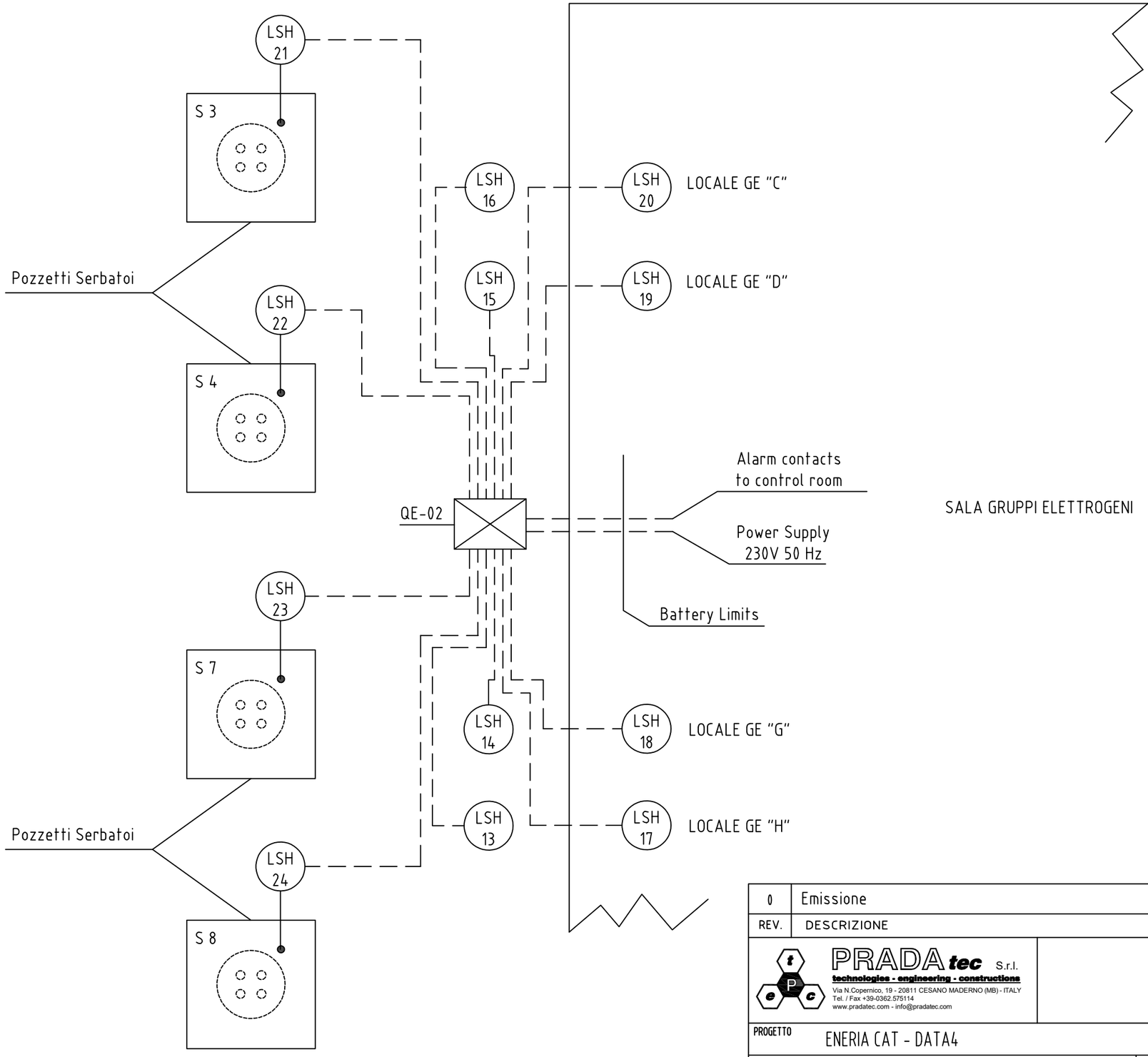
DISEGNO N°: 609-ISCH-004

REV.: 0

FG. 1 DI 2

Il presente disegno e' proprieta' della PRADAtec. Ogni diritto e' riservato secondo i termini di legge.

FILE:



REV.	DESCRIZIONE	DATA	DISEGN.	CONT.	APPR.
0	Emissione	31/03/23	COGI	COGI	PRCE.

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CLIENTE: IMPIANTI ENERGIA - ENERIA CAT

LOCALITA': SETTIMO MILANESE (MI)

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DATACENTER DC L07

COMMESSA: 609

ITEM:

FORMATO:

SCALA:

DISEGNO N°: 609-ISCH-004

REV.: 0

FG. 2 DI 2

FILE:

Il presente disegno e' proprieta' della PRADAtec. Ogni diritto e' riservato secondo i termini di legge.

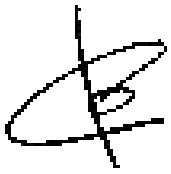
CERTIFICATI

CONFORMITA' LIVELLOSTATI

CONFORMITA' QUADRO ELETTRICO

CONFORMITA' IMPIANTO SISTEMA RILEVATORI DI LIVELLO

COLLAUDO IMPIANTO



www.pradatec.com	**CERTIFICATO DI COLLAUDO PER IMPIANTO ELETTRICO E STRUMENTALE** INSPECTION & TEST CERTIFICATE FOR ELECTRIC & INSTRUMENTAL PLANT	**CERTIFICATO DI COLLAUDO** TEST CERTIFICATE **N° 609-DC07**

DATI GENERALI - GENERAL DATA

CLIENTE -*Customer:*	IMPIANTI ENERGIA - ENERIA	**COMMESSA CLIENTE** - *Client job:*	
IMPIANTO	Impianto rilevazione perdite comb.	**SIGLA** - *Item*	
	Datacenter DC L07	**NS. COMMESSA** - *Our job:*	**609**
CLIENTE FINALE - *End user*	ENERIA CAT		

PROVE EFFETTUATE - *PERFOMED TEST*

POS.	DESCRIZIONE PROVE - *IESIS DESCRIPTION*	TIPO DI PROVA (1) Test type	ESITO RESULT	VALORE ATTESO Expected value	DOC. O NORMA DI RIFERIM. Ref. Doc. or rules	DATA Date	SIGLA Signe
1	CONTROLLO ESECUZ. CONNESSIONI ELETTRICHE Check of electrical connections	V	Positivo *Positive*	Positivo *Positive*		31/03/2023	G.C.
2	CORRISPOND. CABLAGGIO A SCHEMA ELETTRICO Check of electrical wiring	V	Positivo *Positive*	Positivo *Positive*		31/03/2023	G.C.
3	CONTROLLO ESECUZIONE CANALINE ETC. Check of electrical components installation	V	Positivo *Positive*	Positivo *Positive*		31/03/2023	G.C.
4	CONTR. ESECUZ. CONNES. DI PROC. E CORRISP. HOOK UP Check of process connections and accordance with hookup drw.	V	Positivo *Positive*	Positivo *Positive*		31/03/2023	G.C.
5	CONTR. ESECUZ. CONNES. PNEUM. E CORRISP. HOOK UP Check of pneumatic connections and accordance with hookup drw.	V	Positivo *Positive*	Positivo *Positive*			N.A.
6	CONTROLLO MONTAGGIO STRUMENTI Check of instrument installation	V	Positivo *Positive*	Positivo *Positive*		31/03/2023	G.C.
7	VERIFICA CONTINUITA' CIRCUITO DI PROTEZIONE (2) Continuity test of protective carth circuit	S	1Ω	< 10Ω	CEI 64/8		N.A.
8	MISURA RESISTENZA DI ISOLAMENTO (3) Insulation resistence measurement	S	1 MΩ	> 500kΩ	CEI 64/8		N.A.
9	CONTROLLO SIGLATURA CAVI Check of cable item	V	Positivo *Positive*	Positivo *Positive*		31/03/2023	G.C.
10	CORRISP. DISPOSIZ. STRUMENTI A SCHEMA TOPOGAFICO Corrispondence beetwen instrument arrangement and drawing	V	Positivo *Positive*	Positivo *Positive*		31/03/2023	G.C.
11	CONTROLLO TARGHETTATURA JJ.BB. Check of junction box nameplates	N/A	Positivo *Positive*	Positivo *Positive*		31/03/2023	G.C.
12	VERIFICA DEL GRADO DI PROTEZIONE (4) check of junction box IP protection degree	V	Positivo *Positive*	≥ IP55		31/03/2023	G.C.
13	PROVA FUNZIONALE Functional test	F	Positivo *Positive*	Positivo *Positive*		31/03/2023	G.C.

NOTE - *NOTES*

(1) Tipo di prova: **S =** Strumentale**: V** = Visivo: **F =** Funzionale.
(2) Si riporta il valore minimo rilevato nelle varie prove
La prova verifica la continuità del circuito di protezione tra tutte le masse e il/i nodo di terra.
(3) Si riporta il valore minimo della resistenza di isolamento tra conduttori attivi e tra conduttori attivi e massa.
(4) Si verifica dai dati di targa che i componenti abbiano il grado IP minimo richiesto.

Strumento usato per le verifiche:
HT ITALIA 2033 n° di serie 96064260

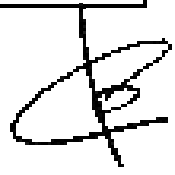
IL COLLAUDO ☐ E' ☐ NON E' STATO ESEGUITO IN PRESENZA DEL CLIENTE.

(1) Test type: **S =** instrumental: **V** = visual: **F** = functional.
(2) The lowest value is reported. The test verifies the community between every instrument earth connection & grund plate(s)
(3) It is reported the lowest value of the insulation resistance among the active conductors and between each conductors and eart
(4) It is checked from the nameplates data that J.B. have the minimun IP degree requested.

Enployed instrument:
HT ITALIA 2033 n° di serie 96064260

TEST ☐ WAS ☐ WAS NOT PERFORMED IN THE PRESENCE OF THE CLIENT.

ESITO PROVE *TESTS RESULT*	LOCALITA' *LOCATION*	DATA *DATE*	COLLAUDATORE PT *P-T INSPECTOR*	COLLAUDATORE CLIENTE *CLIENT INSPECTOR*
Positivo *Positive*	SETTIMO MILANESE (MI)	31/03/2023	G. Codognotto	



SISTEL
WE PROJECT ENERGY

CE

IL QUADRO E' CONFORME
ALLE DIRETTIVE
2014/30/UE - 2014/35/UE

DICHIARAZIONE DI CONFORMITA'

QUADRO ELETTRICO PER BASSA TENSIONE
PER DISTRIBUZIONE

Riferimento nr.:	Ordine 10/2022
Committente:	AEMME DI MORUZZI ALVIO
Impianto:	ALIMENTAZIONE STRUMENTAZIONE 24VDC
Tipo di quadro:	ANS
Identificazione del quadro:	QAST
Descrizione del quadro:	CASSETTA PER ALIMENTAZIONE DI 15 STRUMENTI
Rif. Comm. SISTEL nr.:	22 C_84
Schema nr.:	2894-22
Tensione Un:	230Vac
Frequenza:	50Hz
Corrente Inq:	4A
Corrente C.to-C.to:	<10kA
Grado di protezione:	IP65

Dichiaro che il quadro sopra descritto è stato realizzato in conformità alle Norme:

1) CEI EN 61439-1:2022

Data 15/09/2022

SISTEL
WE PROJECT ENERGY

SISTEL WE PROJECT ENERGY	RAPPORTO DI COLLAUDO Test report	Foglio 1 di 4 Sheet of

Impianto: ALIMENTAZIONI STRUMENTAZIONE 24VDC Plant:	
Cliente: AEMME DI ALVIO MORUZZI Customer:	Riferimento: Ord. n. 10/2022 Reference:
	Commessa: 22 C-84 Commisioning:

Tipo di intervento: ☒ Collaudo interno RCI / Inside testing ☐ Collaudo esterno RCE / Outside testing
Kind of intervention:

COLLAUDO Test	Data/Date: 09/2022	Località/location: SOLARO(MI)
	Presenti: Mr. Valtorta fabio (Sistel Impianti S.r.l.) Presents: Mr. Mr. Mr.	

Oggetto: CASSETTA ALIMENTAZIONE STRUMENTI Object:	Identificazione Q.E.: QAST Identification E.C.:

Pos. Pos.	Quan. Quan.	Descrizione Description	Documenti di riferimento Reference documents
1		SCHEMA	2894-22

Piano controllo qualità Plan quality control	Fase Phase	Descrizione fase Phase descripton	
Esito Result	☒ Materiale accettato Accepted manufactory	☐ Materiale da ricollaudare Manufactory to be retested	☐ Materiale scartato Rejected manufactory

Note / Notes

Documenti allegati / Enclosed documents

Schema elettrico (Electrical diagram) nr.: 2894-22

Autorizzazione alla spedizione Shipping release	☒ SI Yes	☐ NO Not

Sistel Impianti S.r.l.	Cliente Customer	Altro Other
SISTEL WE PROJECT ENERGY		

SISTEL WE PROJECT ENERGY	RAPPORTO DI COLLAUDO Test report	Foglio 2 di 4 Sheet of

Impianto: ALIMENTAZIONI STRUMENTAZIONE 24VDC Plant:	
Cliente: AEMME DI ALVIO MORUZZI Customer:	Riferimento: Ord. n. 10/2022 Reference:
	Commessa: 22 C-84 Commisioning:
Tipo di intervento: ☒ Collaudo interno RCI / Inside testing ☐ Collaudo esterno RCE / Outside testing Kind of intervention:	

COLLAUDO Test	Data/Date: 09/2022	Località/location: SOLARO(MI)
	Presenti: Mr. Valtorta fabio (Sistel Impianti S.r.l.) Presents: Mr. Mr. Mr.	

Oggetto: CASSETTA ALIMENTAZIONE STRUMENTI Object:	Identificazione Q.E.: QAST Identification E.C.:

Quadro B.T.
Low voltage cabinet

Tensione nominale: 230 V a.c.
Rated voltage

Tensioni ausiliarie: 24 V d.c.
Auxiliary voltage

According to: SECONDO CEI EN 61439 -1 & IEC 439-1 ☒ SECONDO CEI EN 60204 -1 & IEC 204-51

A) Controllo visivo
Visual test — OK

B) Prova di funzionamento elettrico
Electrical functional test — OK

C) Prova di rigidità dielettrica
Dielectric test

Tensione applicata: / Applied test voltage — Per circuiti a / For circuits

Tensione applicata: / Applied test voltage — Per circuiti a / For circuits

Tensione applicata: / Applied test voltage — Per circuiti a / For circuits

D) Prova di isolamento (per tutte le tensioni)
Isulation test (for all voltage)

Tensione di misura: / Measurement voltage — Resistenza di isolamento misurata / Isulation resistance measured

E) Verifica mezzi di protezione e del circuito di protezione
Checking of protective measures and the protective circuit

Sistel Impianti S.r.l.	Cliente Customer	Altro Other
SISTEL WE PROJECT ENERGY		

SISTEL WE PROJECT ENERGY	RAPPORTO DI COLLAUDO Test report	Foglio 3 di 4 Sheet of

Impianto: ALIMENTAZIONI STRUMENTAZIONE 24VDC Plant:	
Cliente: AEMME DI ALVIO MORUZZI Customer:	Riferimento: Ord. n. 10/2022 Reference:
	Commessa: 22 C-84 Commisioning:
Tipo di intervento: ☒ Collaudo interno RCI / Inside testing ☐ Collaudo esterno RCE / Outside testing Kind of intervention:	

COLLAUDO Test	Data/Date: 09/2022	Località/location: SOLARO(MI)
	Presenti: Mr. Valtorta fabio (Sistel Impianti S.r.l.) Presents: Mr. Mr. Mr.	

Oggetto: CASSETTA ALIMENTAZIONE STRUMENTI Object:	Identificazione Q.E.: QAST Identification E.C.:

Descrizione Description	Tipo strumento Type of instrument	Fornitore Supplyer	Nr. di serie Number of series

Sistel Impianti S.r.l.	Cliente Customer	Altro Other
SISTEL WE PROJECT ENERGY		

SISTEL WE PROJECT ENERGY	RAPPORTO DI COLLAUDO Test report	Foglio 4 di 4 Sheet of

Impianto: ALIMENTAZIONI STRUMENTAZIONE 24VDC Plant:	
Cliente: AEMME DI ALVIO MORUZZI Customer:	Riferimento: Ord. n. 10/2022 Reference:
	Commessa: 22 C-84 Commisioning:

Tipo di intervento: ☒ Collaudo interno RCI / Inside testing ☐ Collaudo esterno RCE / Outside testing
Kind of intervention:

COLLAUDO Test	Data/Date: 09/2022	Località/location: SOLARO(MI)
	Presenti: Mr. Valtorta fabio (Sistel Impianti S.r.l.) Presents: Mr. Mr. Mr.	

Oggetto: CASSETTA ALIMENTAZIONE STRUMENTI Object:	Identificazione Q.E.: QAST Identification E.C.:

Remarks: ☒ ☐ = Faulty ☒ ☒ = Faulty and repaired ☐ ☒ = Test passed ⊟–⊟ = ~~Item not involved~~

Description		Result	Description		Result
1 Preparation/Painting			**4 Wiring**		
A01.1	Prescribed materials	☐ ☒	D01.1	Laying of cable, combs, cable fixing	☐ ☒
A01.2	Dimensions	☐ ☒	D01.2	One conductor each clamp	☐ ☒
A01.3	Painting, colouring, thickness	☐ ☒	D01.3	Conductors ways (sharp corners)	☐ ☒
2 Assembling			D01.4	~~Terminals, weldings~~	⊟–⊟
B01.1	Devices location	☐ ☒	D01.5	Conductors: type, colour, section	☐ ☒
B01.2	~~Separating for transport~~	⊟–⊟	D01.6	Conductors for PE, PEN	☐ ☒
B01.3	Protection degree IP 65	☐ ☒	D01.7	~~Shielded conductors~~	⊟–⊟
B01.4	Earthing & protection connections	☐ ☒	D01.8	~~Conductors with special laying~~	⊟–⊟
B01.5	Coverings and protection	☐ ☒	D01.9	~~Wire-wrap / Crimp connections~~	⊟–⊟
B01.6	Tightening for bolts and screws	☐ ☒	D01.10	~~Maxi-termi-point connections~~	⊟–⊟
B01.7	Devices marking	☐ ☒	**5 Protective measures**		
B01.8	Devices interchangeability	☐ ☒	Against direct contacts		
B01.9	Terminal boxes	☐ ☒	E01.2	Presence of complete protection	☐ ☒
B01.10	Access to control units	☐ ☒	E01.2	~~Presence of partial protection~~	⊟–⊟
B01.11	Access for outside cables	☐ ☒	Against indirect contacts		
B01.12	Accessory sup. and fixing materials	☐ ☒	E02.1	PE conductor connection	☐ ☒
B01.13	Arc spaces	☐ ☒	E02.2	Earthing devices, supports, doors	☐ ☒
B01.14	~~Mechanical blocks~~	⊟–⊟	E02.3	~~Earthing bars~~	⊟–⊟
B01.15	~~Electrical blocks~~	⊟–⊟	**6 Checks & Tests**		
3 Assembling of electronic devices			F01.1	~~Dielectric test of the main circuits~~	⊟–⊟
C01.1	~~Racks location~~	⊟–⊟	F01.2	~~Isulation test of the auxiliary circuits~~	⊟–⊟
C01.2	~~Cards and interface location~~	⊟–⊟	F01.3	Functional test	☐ ☒
C01.3	~~Connecting terminals~~	⊟–⊟	F01.4	Circuit test	☐ ☒
7 Final check before shipping					
G01.1	Manufacturing as per order	☐ ☒	G01.5	General cleaning, painting adjust.	☐ ☒
G01.2	~~Transport eyebolts~~	⊟–⊟	G01.6	Labels, warning labels, trademark	☐ ☒
G01.3	Packing	☐ ☒	G01.7	~~Drawing compartment~~	⊟–⊟
G01.4	General optical impression	☐ ☒	G01.8	Completed supply	☐ ☒

Sistel Impianti S.r.l.	Cliente Customer	Altro Other
SISTEL WE PROJECT ENERGY		

AEMME DI MORUZZI ALVIO
IMPIANTI ELETTRICI CIVILI E INDUSTRIALI
COSTRUZIONE SISTEMI PER ANALISI GAS
Via Reno,6 20811 Cesano Maderno (MI)
CCCIA di Monza e Brianza albo artigiani N. 0339973
C.F.:MRZLVA50S25L325W P.I.:02836010963
Tel. e Fax: 0362/553411 E-mail: aemme_impianti@libero.it

Spett.le
PRADA TEC srl
Via N. Copernico, 19
20811 Cesano Maderno (MB)

CERTIFICAZIONE IMPIANTO ELETTRICO MISURATORI DI LIVELLO

Fornitura materiale e manodopera per lavori elettrici "MISURATORI DI LIVELLO"

Con la presente la scrivente AEMME di Moruzzi Alvio esecutrice dell'impianto in oggetto, realizzato come da descrizione, schemi e documentazione allegata

CERTIFICA

Che l'impianto in questione è stato realizzato in conformità alle normative vigenti e secondo la regola dell'arte.
Inoltre,

DICHIARA

Che l'impianto è stato sottoposto alle prove richieste della normativa per le apparecchiature.

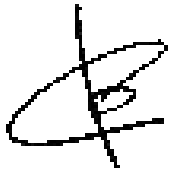
Fornitura ed installazione dei sotto elencati materiali:

- Cavo 5X1,5 FG 180R18
- Pressacavi PG13,5
- Tubo in plastica diam. 32 mm
- Nr 2 quadri comando livelli
- Cavo 3x1,5 FG160R16
- Guaina diam. 16 mm
- Tubo in plastica diametro 20 mm

Cesano Maderno, 31/03/2023

AEMME di Moruzzi Alvio

DATA SHEET TIPICO CAVI ELETTRICI



FS17 450/750 V Repero®

CPR (UE) n°305/11
C_{ca} - s3, d1, a3

Regolamento Prodotti da Costruzione/*Construction Products Regulation*
Classe conforme norme EN 50575:2014 + A1:2016 e EN 13501-6:2014
Class according to standards EN 50575:2014 + A1:2016 and EN 13501-6:2014

DoP n°1018/17 (≤ 6 mm²)
DoP n°1023/17 (> 6 mm²)

CEI UNEL 35716 — Costruzione e requisiti/*Construction and specifications*
CEI EN 60332-1-2 — Propagazione fiamma/*Flame propagation*
2014/35/UE — Direttiva Bassa Tensione/*Low Voltage Directive*
2011/65/CE — Direttiva RoHS/*RoHS Directive*
CA01.00734 — Certificato IMQ-EFP/*IMQ-EFP Certificate*

NB 0051

DESCRIZIONE

Cavo per energia isolato in PVC di qualità S17, con particolari caratteristiche di reazione al fuoco e rispondente al Regolamento Prodotti da Costruzione (CPR).

Conduttore
Corda flessibile di rame rosso ricotto, classe 5

Isolante
Mescola di PVC di qualità S17

Colori
Standard: giallo/verde, blu, marrone, nero, grigio
Altri colori: a richiesta

Marcatura a incisione
BALDASSARI CAVI REPERO® FS17 450/750 V (sez)
Cca-s3,d1,a3 IEMMEQU EFP

CARATTERISTICHE TECNICHE

Tensione nominale Uo/U: 450/750 V

Temperatura massima di esercizio: 70°C

Temperatura minima di esercizio: -10°C
(in assenza di sollecitazioni meccaniche)

Temperatura minima di posa: 5°C

Temperatura massima di corto circuito: 160°C

Sforzo massimo di trazione: 50 N/mm²

Raggio minimo di curvatura: 4 volte il diametro esterno massimo

Condizioni di impiego
Cavi adatti all'alimentazione elettrica in costruzioni ed altre opere di ingegneria civile con obiettivo di limitare la produzione e la diffusione di fuoco e di fumo.
Per installazioni entro tubazioni in vista o incassate o sistemi chiusi similari.
Adatti per installazione fissa e protetta in apparecchi di illuminazione ed apparecchiature di interruzione e comando.
La sezione di 1 mm² è prevista (in aggiunta alle rimanenti) soltanto per cablaggi interni di quadri elettrici per segnalamento e comando o per circuiti elettrici di ascensori e montacarichi.
Per installazioni a rischio di incendio la temperatura massima di esercizio non deve superare i 55°C. (rif. CEI 20-40)

DESCRIPTION

Power cable, PVC insulated S17 quality, with special fire reaction characteristics according to Construction Products Regulation (CPR).

Conductor
Plain copper flexible wire, class 5

Insulation
PVC compound, S17 quality

Colours
Standard: yellow/green, blue, brown, black, grey
Other colours: on demand

Embossing marking
BALDASSARI CAVI REPERO® FS17 450/750 V (section)
Cca-s3,d1,a3 IEMMEQU EFP

TECHNICAL CHARACTERISTICS

Nominal voltage Uo/U: *450/750 V*

Maximum operating temperature: *70°C*

Minimum operating temperature: *-10°C*
(without mechanical stress)

Minimum installation temperature: *5°C*

Maximum short circuit temperature: *160°C*

Maximum tensile stress: *50 N/mm²*

Minimum bending radius: *4 x maximum external diameter*

Use and installation
Cables suitable for electrical power systems in constructions and other civil engineering works in order to limit fire spread and smoke emission.
For installation in surface conduits or embedded conduits or similar closed systems.
Suitable for fixed and protected installation in lighting appliances and switching and control equipments.
The 1 mm² section is provided (in addition to others) only for internal wiring in switchboards for signalling and control or for electric circuits of lifts and hoists.
For fire risk installations, the maximum temperature must not exceed 55°C. (ref. CEI 20-40)

BALDASSARI CAVI

Formazione *Formation* n° x mm²	Ø indicativo conduttore *Approx. conductor Ø* mm	Spessore medio isolante *Average insulation thickness* mm	Ø indicativo produzione *Approx. production Ø* mm	Peso indicativo cavo *Approx. cable weight* kg/km	Resistenza elettrica max a 20°C *Max. electrical resistance at 20°C* ohm/km	Portata di corrente a 30°C in tubo in aria *Current rating at 30°C In pipe in air* A
1 x 1	1,3	0,7	2,8	15	19,5	12
1 x 1,5	1,6	0,7	3,0	20	13,3	15,5
1 x 2,5	1,9	0,8	3,7	31	7,98	21
1 x 4	2,5	0,8	4,2	46	4,95	28
1 x 6	3,0	0,8	4,6	65	3,30	36
1 x 10	4,0	1,0	6,1	115	1,91	50
1 x 16	5,0	1,0	7,3	165	1,21	68
1 x 25	6,2	1,2	9,0	260	0,780	89
1 x 35	7,6	1,2	10,1	350	0,554	110
1 x 50	8,9	1,4	12,1	500	0,386	134
1 x 70	10,5	1,4	13,7	700	0,272	171
1 x 95	12,5	1,6	15,9	920	0,206	207
1 x 120	13,7	1,6	17,1	1120	0,161	239
1 x 150	15,0	1,8	19,2	1400	0,129	275
1 x 185	17,7	2,0	22,0	1700	0,106	314
1 x 240	19,9	2,2	25,2	2210	0,0801	369

N.B. Calcolo della portata di corrente eseguito considerando un circuito con 3 conduttori attivi.
N.B. Calculation of current rating performed considering a circuit with 3 loaded conductors.

Bassa Tensione
Low Voltage

FG16OR16 0,6/1 kV Repero®

Energia
Power

CPR (UE) n°305/11
C_{ca} - s3, d1, a3

Regolamento Prodotti da Costruzione/*Construction Products Regulation*
Classe conforme norme EN 50575:2014 + A1:2016 e EN 13501-6:2014
Class according to standards EN 50575:2014 + A1:2016 and EN 13501-6:2014

DoP n°1021/17

CEI 20-13 - CEI UNEL 35318 Costruzione e requisiti/*Construction and specifications*
CEI EN 60332-1-2 Propagazione fiamma/*Flame propagation*
2014/35/UE Direttiva Bassa Tensione/*Low Voltage Directive*
2011/65/CE Direttiva RoHS/*RoHS Directive*
CA01.00755 Certificato IMQ-EFP/*IMQ-EFP Certificate*

NB 0051

DESCRIZIONE

Cavo multipolare per energia isolato in gomma etilenpropilenica ad alto modulo di qualità G16, sotto guaina di PVC, con particolari caratteristiche di reazione al fuoco e rispondente al Regolamento Prodotti da Costruzione (CPR).

Conduttore
Corda flessibile di rame rosso ricotto, classe 5

Isolante
Mescola di gomma etilpropilenica ad alto modulo di qualità G16

Riempitivo
Mescola di materiale non igroscopico

Guaina esterna
Mescola di PVC di qualità R16

Colore anime
Normativa HD 308

Colore guaina
Grigio

Marcatura a inchiostro
BALDASSARI CAVI REPERO® FG16OR16 0,6/1 kV (sez) Cca-s3,d1,a3 IEMMEQU EFP (anno) (m) (tracciabilità)

CARATTERISTICHE TECNICHE

Tensione nominale Uo/U: 0,6/1 kV

Temperatura massima di esercizio: 90°C

Temperatura minima di esercizio: -15°C
(in assenza di sollecitazioni meccaniche)

Temperatura minima di posa: 0°C

Temperatura massima di corto circuito:
250°C fino alla sezione 240 mm², oltre 220°C

Sforzo massimo di trazione: 50 N/mm²

Raggio minimo di curvatura: 4 volte il diametro esterno massimo

Condizioni di impiego
Cavi adatti all'alimentazione elettrica in costruzioni ed altre opere di ingegneria civile con l'obiettivo di limitare la produzione e la diffusione di fuoco e di fumo. Per impiego all'interno in locali anche bagnati o all'esterno. Adatto per posa fissa su murature e strutture metalliche in aria libera, in tubo o canaletta o sistemi similari. Ammessa anche la posa interrata. (rif. CEI 20-67)

DESCRIPTION

Multi-core power cable HEPR insulated (G16 quality), PVC sheated, with special fire reaction characteristics according to Construction Products Regulation (CPR).

Conductor
Plain copper flexible wire, class 5

Insulation
Rubber HEPR compound, G16 quality

Filler
Non-hygroscopic compound

Outer sheath
PVC compound, R16 quality

Cores colour
HD 308 Standard

Sheath colour
Grey

Inkjet marking
BALDASSARI CAVI REPERO® FG16OR16 0,6/1 kV (section) Cca-s3,d1,a3 IEMMEQU EFP (year) (m) (traceability)

TECHNICAL CHARACTERISTICS

Nominal voltage Uo/U: *0,6/1 kV*

Maximum operating temperature: *90°C*

Minimum operating temperature: *-15°C (without mechanical stress)*

Minimum installation temperature: *0°C*

Maximum short circuit temperature:
250°C up to 240 mm² section, over 220°C

Maximum tensile stress: *50 N/mm²*

Minimum bending radius: *4 x maximum external diameter*

Use and installation
Cables suitable for electrical power system in constructions and other civil engineering works in order to limit fire spread and smoke emission. Suitable to be used indoor or outdoor, even in wet environments; it can be fixed on walls and/or metal structures, free in air, inside pipes or similar systems.
Suitable also for laying underground. (ref. CEI 20-67)

BALDASSARI CAVI

FG16OR16 0,6/1 kV Repero®

Formazione *Formation*	Ø indicativo conduttore *Approx. conductor Ø*	Spessore medio isolante *Average insulation thickness*	Spessore medio guaina *Average sheath thickness*	Ø indicativo produzione *Approx. production Ø*	Peso indicativo cavo *Approx. cable weight*	Resistenza elettrica max a 20°C *Max. electrical resistance at 20°C*	Portata di corrente *Current rating* In tubo in aria *In pipe in air 30°C*	 In tubo interrato *Underground in pipe 20°C*
n° x mm²	mm	mm	mm	mm	kg/km	ohm/km	A	A
2 x 1,5	1,6	0,7	1,8	9,6	127	13,3	22	23
2 x 2,5	1,9	0,7	1,8	10,6	168	7,98	30	30
2 x 4	2,5	0,7	1,8	11,7	215	4,95	40	39
2 x 6	3,0	0,7	1,8	12,7	270	3,30	51	49
2 x 10	4,0	0,7	1,8	14,8	390	1,91	69	66
2 x 16	5,0	0,7	1,8	16,6	570	1,21	91	86
2 x 25	6,2	0,9	1,8	20,8	865	0,780	119	111
2 x 35	7,6	0,9	1,8	23,0	1120	0,554	146	136
2 x 50	8,9	1,0	1,8	26,6	1520	0,386	175	168
2 x 70	10,5	1,1	1,8	29,6	2020	0,272	221	207
2 x 95	12,5	1,1	2,0	34,0	2680	0,206	265	245
2 x 120	13,7	1,2	2,0	37,4	3320	0,161	305	284
2 x 150	15,0	1,4	2,2	41,6	4180	0,129	334	324
3 x 1,5	1,6	0,7	1,8	10,1	146	13,3	19,5	19
3 x 2,5	1,9	0,7	1,8	11,2	191	7,98	26	25
3 x 4	2,5	0,7	1,8	12,3	250	4,95	35	32
3 x 6	3,0	0,7	1,8	13,4	320	3,30	44	41
3 x 10	4,0	0,7	1,8	15,7	480	1,91	60	55
3 x 16	5,0	0,7	1,8	17,6	705	1,21	80	72
3 x 25	6,2	0,9	1,8	22,1	1060	0,780	105	93
3 x 35	7,6	0,9	1,8	24,5	1400	0,554	128	114
3 x 50	8,9	1,0	1,8	28,4	1910	0,386	154	141
3 x 70	10,5	1,1	1,9	31,9	2590	0,272	194	174
3 x 95	12,5	1,1	2,0	35,4	3320	0,206	233	206
3 x 120	13,7	1,2	2,1	39,0	4130	0,161	268	238
3 x 150	15,0	1,4	2,3	43,6	5200	0,129	300	272
3 x 185	17,7	1,6	2,4	51,7	6650	0,106	340	306
3 x 240	19,9	1,7	2,6	59,0	8700	0,0801	398	360
3 x 300	22,4	1,8	2,8	65,4	10900	0,0641	455	-

N.B. Il coefficiente di resistività termica del terreno preso a riferimento per il calcolo della portata dei cavi interrati è di 1,5 K.m/W, profondità di posa 0,8 m. Calcolo della portata di corrente eseguito considerando un circuito con 3 conduttori attivi (per cavi unipolari), eseguito considerando 2 conduttori attivi per cavi a 2 anime e 3 conduttori attivi per le altre formazioni.

N.B. The thermal resistivity coefficient used as a reference for the calculation of the underground cables current rating is 1,5 K.m/W, 0,8 m installation depth. Calculation of current rating performed considering a circuit with 3 loaded conductors (for single-core cables); performed considering 2 loaded conductors for 2 core cables and 3 loaded conductors for other formations.

BALDASSARI® CAVI

FG16OR16 0,6/1 kV Repero®

Formazione	Ø indicativo conduttore	Spessore medio isolante	Spessore medio guaina	Ø indicativo produzione	Peso indicativo cavo	Resistenza elettrica max a 20°C	Portata di corrente *Current rating*	
Formation	*Approx. conductor Ø*	*Average insulation thickness*	*Average sheath thickness*	*Approx. production Ø*	*Approx. cable weight*	*Max. electrical resistance at 20°C*	In tubo in aria *In pipe in air 30°C*	In tubo interrato *Underground in pipe 20°C*
n° x mm²	mm	mm	mm	mm	kg/km	ohm/km	A	A
4 x 1,5	1,6	0,7	1,8	10,8	168	13,3	19,5	19
4 x 2,5	1,9	0,7	1,8	12,0	220	7,98	26	25
4 x 4	2,5	0,8	1,8	13,3	300	4,95	35	32
4 x 6	3,0	0,7	1,8	14,5	390	3,30	44	41
4 x 10	4,0	0,7	1,8	17,0	590	1,91	60	55
4 x 16	5,0	0,7	1,8	19,2	865	1,21	80	72
4 x 25	6,2	0,9	1,8	24,1	1310	0,780	105	93
3 x 35 + 25	7,6/6,2	0,9/0,9	1,8	25,6	1580	0,554/0,780	128	114
3 x 50 + 25	8,9/6,2	1,0/0,9	1,8	29,7	2400	0,386/0,780	154	141
3 x 70 + 35	10,5/7,6	1,1/0,9	1,9	33,9	2920	0,272/0,554	194	174
3 x 95 + 50	12,5/8,9	1,1/1,0	2,1	38,2	3820	0,206/0,386	233	206
3 x 120 + 70	13,7/10,5	1,2/1,1	2,2	42,0	4790	0,161/0,272	268	238
3 x 150 + 95	15,0/12,5	1,4/1,1	2,4	47,0	6080	0,129/0,206	300	272
3 x 185 + 95	17,7/12,5	1,6/1,1	2,5	54,4	7460	0,106/0,206	340	306
3 x 240 + 150	19,9/15,0	1,7/1,4	2,7	62,1	9940	0,0801/0,129	398	360
3 x 300 + 150	22,4/15,0	1,8/1,4	2,9	68,8	12200	0,0641/0,129	455	-
5 x 1,5	1,6	0,7	1,8	11,7	200	13,3	19,5	19
5 x 2,5	1,9	0,7	1,8	13,0	265	7,98	26	25
5 x 4	2,5	0,7	1,8	14,5	355	4,95	35	32
5 x 6	3,0	0,7	1,8	15,8	470	3,30	44	41
5 x 10	4,0	0,7	1,8	18,6	710	1,91	60	55
5 x 16	5,0	0,7	1,8	21,2	1050	1,21	80	72
5 x 25	6,2	0,9	1,8	26,5	1590	0,780	105	93
5 x 35	7,6	0,9	1,8	29,5	2110	0,554	128	114
5 x 50	8,9	1,0	2,0	34,8	3210	0,386	154	141

N.B. Il coefficiente di resistività termica del terreno preso a riferimento per il calcolo della portata dei cavi interrati è di 1,5 K.m/W, profondità di posa 0,8 m. Calcolo della portata di corrente eseguito considerando un circuito con 3 conduttori attivi (per cavi unipolari); eseguito considerando 2 conduttori attivi per cavi a 2 anime e 3 conduttori attivi per le altre formazioni.

N.B. The thermal resistivity coefficient used as a reference for the calculation of the underground cables current rating is 1,5 K.m/W, 0,8 m installation depth. Calculation of current rating performed considering a circuit with 3 loaded conductors (for single-core cables); performed considering 2 loaded conductors for 2 core cables and 3 loaded conductors for other formations.